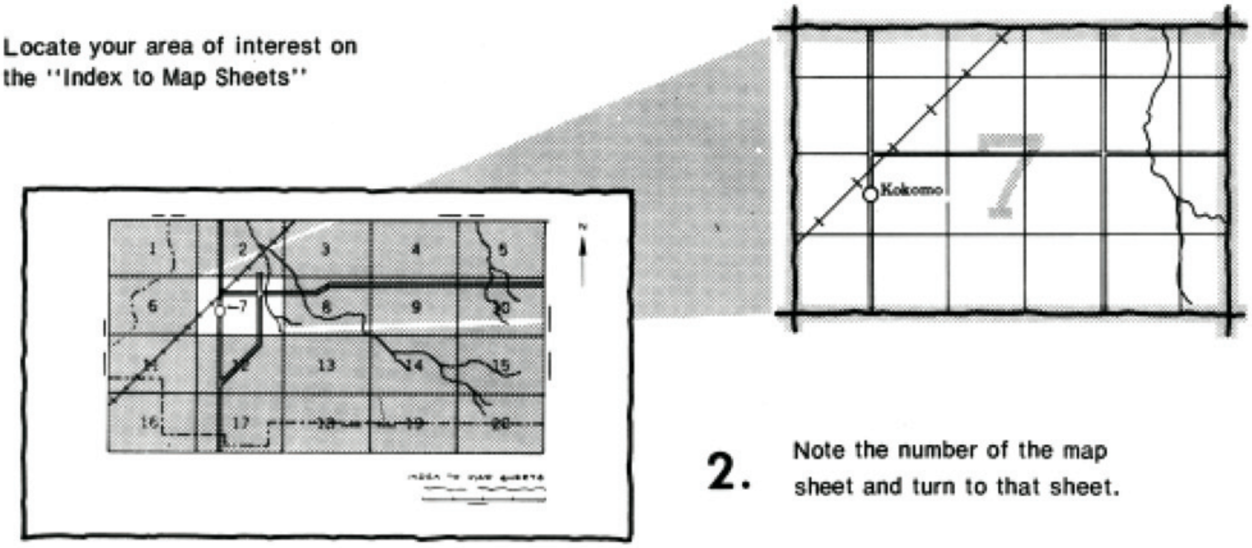
SOIL SURVEY OF

Carter County, Oklahoma

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Oklahoma Agricultural Experiment Station

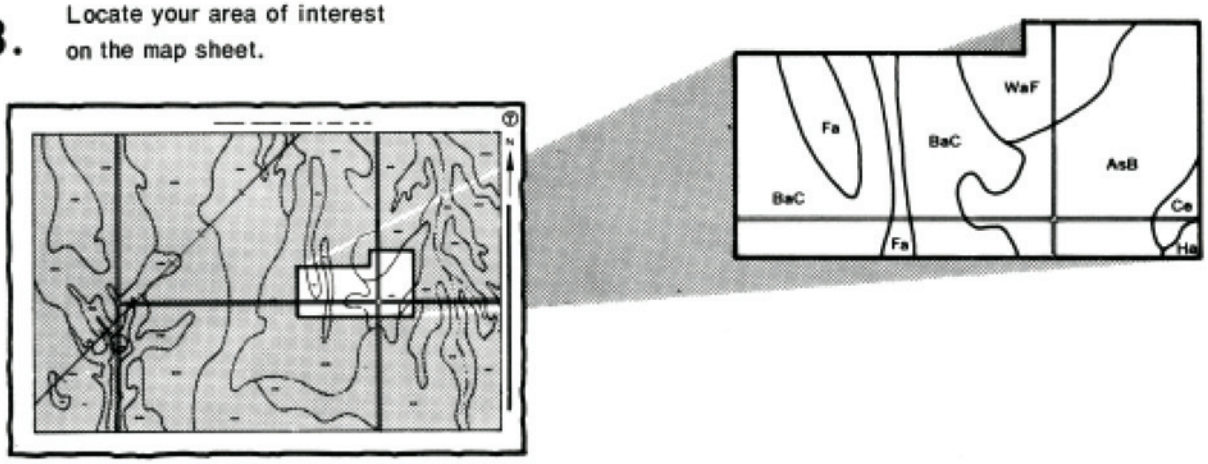
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets"

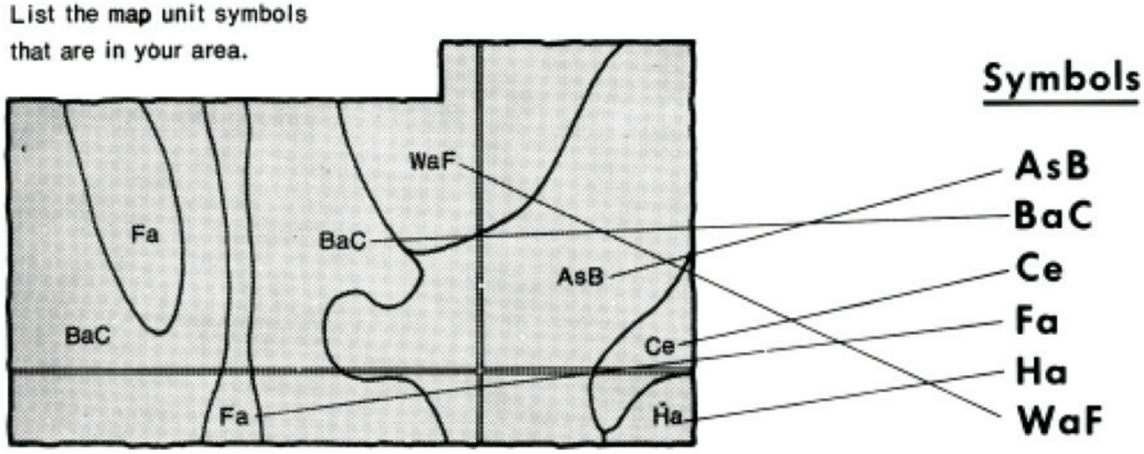


2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.

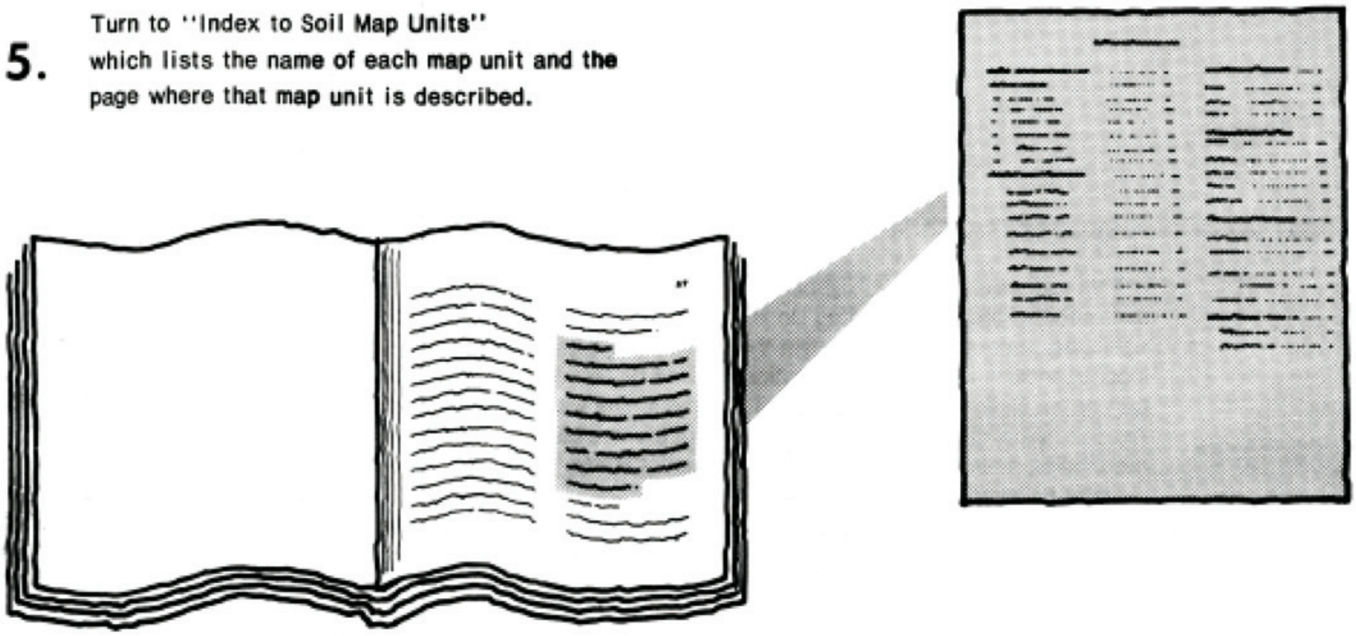


4. List the map unit symbols that are in your area.

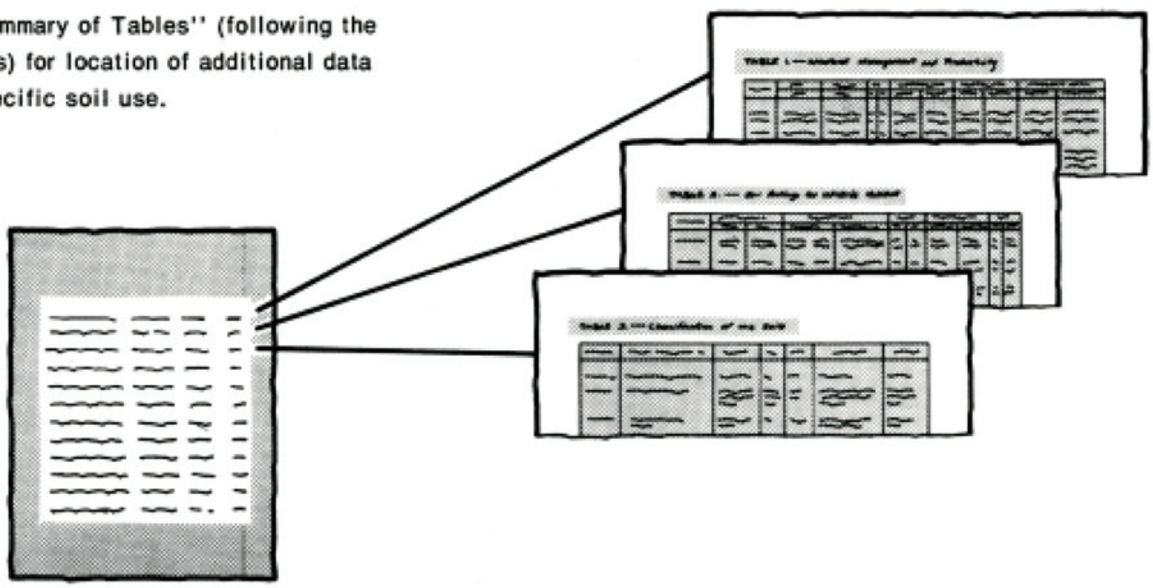


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1968-75. Soil names and descriptions were approved in 1975. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1975. This survey was made cooperatively by the Soil Conservation Service and the Oklahoma Agricultural Experiment Station. It is part of the technical assistance furnished to the Arbuckle Conservation District, Carter County.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

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Foreword

The Soil Survey of Carter County contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

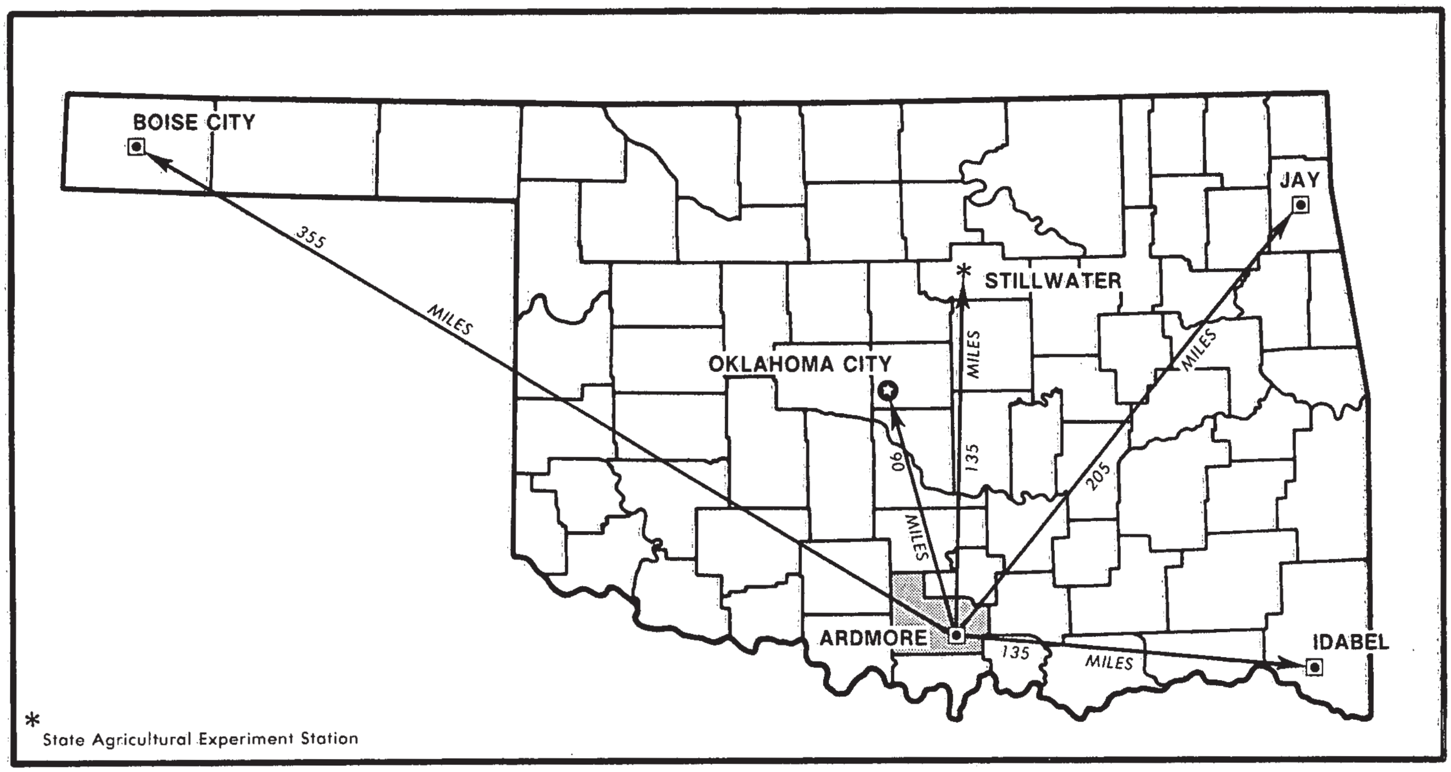
Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

Roland R. Willis

Roland R. Willis
State Conservationist
Soil Conservation Service



Location of Carter County in Oklahoma.

SOIL SURVEY OF CARTER COUNTY, OKLAHOMA

By Gordon E. Moebius and Armine J. Maxwell, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with Oklahoma Agricultural Experiment Station

CARTER COUNTY is in the south-central part of Oklahoma (see facing page). It has an area of 535,680 acres, or 837 square miles. The county seat is Ardmore, which had a population of about 20,881 in 1970.

The county is largely rural. Raising beef cattle is the chief enterprise. Oil and gas production, as well as manufacturing, contribute much to the economy. The principal farm crops are alfalfa, winter wheat, peanuts, and grain sorghums. Most of the crops are grown in the northern part of the county on the nearly level to gently sloping uplands and terraces and on the flood plains of the Washita River and Caddo Creek and its tributaries.

General nature of the county

This section contains general information about Carter County. Briefly discussed are general facts about the county; the climate; the physiography, drainage, and relief; the farming; and the mineral resources. The statistics used are largely from reports of the Bureau of the Census and from the State Crop and Livestock Reporting Service.

In 1970, Carter County had a population of 37,349. Ardmore, the county seat, is the largest city in the county. Other incorporated towns are Healdton, Wilson, Lone Grove, Ratliff City, Springer, Dickson, and Gene Autry.

Climate

Carter County is hot in summer. An occasional surge of cold air in winter causes a sharp drop in the otherwise mild temperature. Rainfall is uniformly distributed throughout the year, reaching a slight peak in spring. Snowfall is infrequent. Annual total precipitation is normally adequate for peanuts, feed grains, and small grains.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Ardmore, Oklahoma, for the period 1951-74. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 46 degrees F, and the average daily minimum temperature is 34 degrees. The lowest temperature on record, which occurred at Ardmore on January 1, 1962, is 3 degrees. In summer the average temperature is 83 degrees, and the average daily maximum temperature is 94 degrees. The highest recorded temperature, which occurred on August 5, 1964, is 109 degrees.

Growing degree days, shown in table 1, are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 21 inches, or 62 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 15 inches. The heaviest 1-day rainfall during the period of record was 7.35 inches at Ardmore on April 12, 1967. Thunderstorms occur on about 50 days each year, 18 of which are in summer.

Average seasonal snowfall is 5 inches. The greatest snow depth at any one time during the period of record was 7 inches. On the average, 1 day has at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is less than 55 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The percentage of possible sunshine is 75 in summer and 55 in winter. The prevailing wind is from the south. Average windspeed is highest, 13 miles per hour, in March.

Tornadoes and severe thunderstorms, which occur occasionally, are local and of short duration. The pattern of damage is variable and spotty.

Climatic data in this section were specially prepared for the Soil Conservation Service by the National Climatic Center, Asheville, North Carolina.

Physiography, drainage, and relief

Carter County is dominantly woodland soils and about one-fourth prairie soils. Many areas of wooded soils have been cleared. The dominant trees were blackjack oak, post oak, and scattered elm. In most places the understory is tall native grasses. On the prairie soils the plant cover is mostly little bluestem, indiangrass, switchgrass, and scattered forbs.

The northern part of the county drains into the Washita River. The southern part drains principally into the Walnut Bayou, Hickory Creek, or Wilson Creek. These streams eventually flow into the Red River, south of Carter County. Ardmore, the county seat, is at an elevation of 886 feet.

The extreme northern part of the county is rocky, sloping to steep limestone hills, which extend in a west-to-east band along the northern boundary. The main vegetation is prairie grasses.

The southern border of the county is mostly nearly level to sloping tree covered uplands. The soils formed in deeply weathered soft sandstone, often referred to as pack sand. Gully erosion has been severe on most of the area that has been cultivated.

The uplands in the rest of the county are dominantly intermingled areas of very gently sloping to strongly sloping tree covered ridges and side slopes and narrow to broad, nearly level to gently sloping prairie valleys.

The largest flood plains are along the Walnut Bayou, Caddo Creek, Wildhorse Creek, and the Washita River.

Farming

Farming had been well established in Carter County by 1909. About 100,000 acres was in cotton, corn, and oats. In 1934, these crops were still dominant, but the acreage had dropped to about 45,000 acres. By 1971, the acreage in cotton, corn, and oats had dropped to about 1,500 acres.

Currently, about 11,400 acres is in peanuts, wheat, and grain sorghum. Much of the cropland once cultivated is now severely gullied. Beef cattle graze the native grasses that have evolved through natural revegetation. Other areas, formerly cropland, are established in tame pasture grasses.

Mineral resources

Oil and gas production is a major contribution to the economy of the county.

Limestone is abundant in the Arbuckle Mountains in the northern part of Carter County and in the Criner Hills in the south-central part. It is quarried and crushed for production of gravel for road construction.

The supply of water from underground sources ranges from abundant to scarce. As a result of the soluble salts in some areas, however, the water is unsuitable. The best quality water is mostly in manmade impoundments.

The largest lakes in the county are Lake Murray, Lake Jean Neustadt, Rock Creek Reservoir, and Mountain Lake. There are about 60 small watershed lakes. Several more are to be constructed in the near future.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily

available to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land use planning

The general soil map at the back of this publication shows, in color, map units that have a distinct pattern of soils and of relief and drainage. Each map unit is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

Very shallow to deep, loamy or clayey, sloping to steep soils on uplands

The three units in this group make up about 22 percent of Carter County. The soils are used mainly for native range and less extensively for tame pasture.

1. Kiti-Rock outcrop

Shallow and very shallow, sloping to steep, loamy soils over limestone, and rock outcrop; on uplands

This unit makes up about 7 percent of the county. It is about 54 percent Kiti soils, 16 percent Rock outcrop, and 30 percent minor soils.

Kiti soils are shallow and very shallow, sloping to steep, and well drained. They are loamy and have coarse limestone fragments throughout. Rock outcrop is mostly limestone.

Minor in this unit are Heiden, Renfrow, and Grainola soils, and on narrow flood plains, Bergstrom soils. Pits is also in this map unit.

Because the soils are shallow and steep, nearly all the acreage is used as range.

The chief management concern is the invasion of brush and weeds in areas that have been poorly managed.

2. Windthorst-Weatherford-Darnell

Deep to shallow, sloping to moderately steep, loamy soils that have a loamy or clayey subsoil over sandstone and shale; on uplands

This unit makes up about 10 percent of the county. It is about 45 percent Windthorst soils, 24 percent Weatherford soils, 8 percent Darnell soils, and 23 percent minor soils.

Windthorst soils are deep, sloping to moderately steep, and moderately well drained. They are loamy and have a clayey subsoil.

Weatherford soils are deep, sloping to strongly sloping, and well drained. They are loamy throughout.

Darnell soils are shallow, sloping to moderately steep, and well drained to somewhat excessively drained. They are loamy throughout.

Minor in this unit are Woodford and Chigley soils.

Nearly all the acreage is used as range.

The chief management concerns are protecting the range from fire and controlling grazing in order to reduce water erosion.

3. Steedman-Tamford-Heiden

Moderately deep and deep, sloping to moderately steep, loamy and clayey soils that have a clayey subsoil over clayey sediment or shale; on uplands

This unit makes up about 5 percent of the county. It is about 34 percent Steedman soils, 30 percent Tamford soils, 25 percent Heiden soils, and 11 percent minor soils.

Steedman soils are moderately deep, sloping to moderately steep, and moderately well drained. They are loamy and have a clayey subsoil.

Tamford and Heiden soils are deep, sloping to strongly sloping, and well drained. Tamford soils are loamy and have clayey underlying layers. Heiden soils are clayey throughout.

Minor in this unit are Grainola and Woodford soils, and on narrow flood plains, Bunyan and Bergstrom soils.

Nearly all the acreage is used for range and tame pasture.

The chief management concerns are controlling grazing, maintaining fertility, and reducing water erosion.

Deep, loamy or sandy, nearly level to sloping soils on uplands

The four units in this group make up about 65 percent of Carter County. The soils are used chiefly for tame pasture and to a smaller extent for native range and cultivated crops. In most areas they are suited to cultivated crops.

4. Normangee-Wilson-Durant

Deep, nearly level to gently sloping, loamy soils that have a clayey subsoil over clayey sediment or shale; on uplands

This unit makes up about 17 percent of the county. It is about 31 percent Normangee soils, 14 percent Wilson soils, 12 percent Durant soils, and 43 percent minor soils.

Normangee soils are deep, very gently sloping and gently sloping, and moderately well drained. They are loamy and have a clayey subsoil.

Wilson soils are deep, nearly level and very gently sloping, and somewhat poorly drained. They also are loamy and have a clayey subsoil.

Durant soils are deep, very gently sloping and gently sloping, and moderately well drained. They are loamy and have a loamy or clayey subsoil.

Minor in this unit are Burleson, Clarita, Heiden, and Steedman soils, and on narrow flood plains, Bunyan, Elandco, and Pulaski soils.

This unit is used for tame pasture, cultivated crops, and range. The main crops are small grain, grain sorghum, and forage sorghum.

The chief concerns of management are preserving soil structure and fertility and controlling water erosion.

5. Weatherford-Windthorst

Deep, very gently sloping to sloping, loamy soils that have a loamy or clayey subsoil over sandstone and shale; on uplands

This unit makes up about 30 percent of the county. It is about 40 percent Weatherford soils, 35 percent Windthorst soils, and 25 percent minor soils.

Weatherford soils are deep, very gently sloping to sloping and well drained. They are loamy throughout. They formed over sandstone.

Windthorst soils are deep, very gently sloping to sloping, and moderately well drained. They are loamy and have a clayey subsoil. They formed over shale.

Minor in this unit are Konsil, Duffau, Stephenville, and Darnell soils, and on narrow flood plains, Bunyan, Bergstrom, and Pulaski soils.

This unit is used for tame pasture, cultivated crops, and range. The main cultivated crops are small grain, grain sorghum, and forage sorghum.

The chief management concerns are maintaining soil fertility, controlling water erosion in cultivated areas, and controlling brush on the range and in areas used for tame pasture.

6. Konsil-Eufaula

Deep, nearly level to sloping, sandy soils that have a loamy or sandy subsoil over loamy and sandy sediment or soft sandstone; on uplands

This unit makes up about 14 percent of the county. It is about 75 percent Konsil soils, 2 percent Eufaula soils, and 23 percent minor soils.

Konsil soils are deep, nearly level to sloping, and well drained. They are sandy and have a sandy subsoil. A sizable acreage is severely eroded. Numerous gullies have cut deep into the subsoil.

Eufaula soils are deep, mostly gently sloping to sloping, and somewhat excessively drained. They have a thick sandy surface layer and a loamy or sandy subsoil.

Minor in this unit are Weatherford and Windthorst soils, and on narrow flood plains, Kemp, Tullahassee, and Pulaski soils.

This unit is used for tame pasture, cultivated crops, and range. The cultivated crops are peanuts, small grain, and forage sorghum.

The chief concerns of management are maintaining soil fertility and structure and controlling soil blowing and water erosion.

7. Chickasha-Renfrow-Zaneis

Deep, very gently sloping and gently sloping, loamy soils that have a loamy or clayey subsoil over sandstone or over clay and shale; on uplands

This unit makes up about 4 percent of the county. It is about 48 percent Chickasha soils, 38 percent Renfrow soils, 7 percent Zaneis soils, and 7 percent minor soils.

Chickasha soils are deep, very gently sloping and gently sloping, and well drained. They are loamy throughout.

Renfrow soils are deep, very gently sloping and gently sloping, and well drained. They are loamy and have a clayey or loamy subsoil.

Zaneis soils are deep, gently sloping, and well drained. They are loamy throughout.

Minor in this unit are Tamford and Windthorst soils and Oil-waste land.

This unit is used for tame pasture, cultivated crops, and range. The main cultivated crops are small grain, grain sorghum, and forage sorghum.

The chief management concerns are preserving soil structure, maintaining fertility, and controlling water erosion.

Deep, loamy, nearly level to gently sloping soils on flood plains or terraces

The two units in this group make up about 13 percent of Carter County. Most of the cultivated crops grown in the county are on the soils of this group. The largest acreage is used for tame pasture. A small acreage is native range.

8. Konawa-Dale

Deep, nearly level and very gently sloping, loamy soils over sandy or loamy sediment; on terraces

This unit makes up about 2 percent of the county. It is about 50 percent Konawa soils, 30 percent Dale soils, and 20 percent minor soils.

Konawa soils are deep, nearly level and very gently sloping, and well drained. They are loamy and have a loamy subsoil.

Dale soils are deep, nearly level, and well drained. They are loamy throughout.

Minor in this unit are the strongly sloping to moderately steep Konawa soils, and on narrow flood plains, Pulaski and Bunyan soils.

Nearly all the acreage is used for cultivated crops and tame pasture. The main crops are peanuts, grain sorghum, and forage sorghum.

The chief concerns of management are maintaining soil structure and fertility and controlling soil blowing and water erosion.

9. Pulaski-Bunyan-Bergstrom

Deep, nearly level and very gently sloping, loamy soils over loamy or sandy sediment; on flood plains

This unit makes up about 11 percent of the county. It is about 34 percent Pulaski soils, 23 percent Bunyan soils, 12 percent Bergstrom soils, and 31 percent minor soils.

Pulaski and Bunyan soils are deep, nearly level to gently sloping, and well drained. Bunyan soils are loamy throughout. Pulaski soils are loamy. Below the surface are a few thin sandy layers.

Bergstrom soils are deep, nearly level, and well drained. They have a loamy surface layer and a loamy subsoil.

Minor in this unit are Elandco, Healdton, Miller, Weswood, Watonga, and Yahola soils.

This unit is used mainly for tame pasture and cultivated crops. The main crops are small grain, alfalfa, and forage sorghum.

The chief management concerns are maintaining soil structure and fertility and providing protection against damaging flooding.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have a profile that is almost alike make up a *soil series.* Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Chickasha loam, 2 to 5 percent slopes, eroded, is one of several phases within the Chickasha series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes, soil associations, and undifferentiated groups.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Kiti-Grainola complex, 5 to 20 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. Konsil and Weatherford soils, gullied, is an undifferentiated group in this survey area.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Pits is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 4, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

Soil descriptions

1—**Bergstrom silt loam.** This is a deep, nearly level, well drained soil that is moderately permeable. It occurs as narrow to wide areas along streams and is occasionally flooded.

In a representative profile the upper 6 inches of the surface layer is grayish brown, moderately alkaline silt loam. The lower 18 inches is dark grayish brown, moderately alkaline silt loam. The next 31 inches is brown, moderately alkaline silty clay loam. The underlying layer is reddish brown, moderately alkaline silty clay loam.

The soil is high in natural fertility, organic matter content, and available water capacity. It is alkaline throughout.

About 15 percent of this map unit is included areas of soils that are noncalcareous in the surface layer and more sandy in the upper 40 inches but are otherwise similar to the Bergstrom soil. About 5 percent is areas where the soil is lighter colored within 10 to 20 inches of the surface.

The potential is high for most crops commonly grown in the county. The main crops are small grain, alfalfa, grain sorghum, and tame pasture.

The chief concerns in management are flooding, soil structure, and fertility. Flooding is a hazard in most years. The cropping system should provide adequate amounts of residue. Excessive tillage should be avoided.

The potential is low for urban use of this soil because of the flood hazard in most years. Major flood control measures are needed. Capability subclass IIw; Loamy Bottomland range site.

2—**Bergstrom silty clay loam.** This is a deep, nearly level, well drained soil on flood plains. It formed in smooth, narrow to wide areas along streams, under a cover of scattered trees and tall native grasses. It is occasionally flooded.

Typically, the upper 14 inches of the surface layer is dark gray heavy silty clay loam. The lower 20 inches is grayish brown, moderately alkaline silty clay loam. The next 26 inches is brown, moderately alkaline silty clay loam.

This soil is high in natural fertility and organic matter content. It is moderately alkaline throughout. It has good tilth if well managed. Permeability is moderate, and the available water capacity is high.

About 15 percent of this map unit is included areas of Bergstrom silt loam and 5 percent areas of Elandco soils. About 5 percent is areas where the soil is redder in the lower part but is otherwise similar to the Bergstrom soil.

The potential is high for row crops, small grain, pasture, and hay.

Tilth can be maintained by returning ample crop residue to the soil. Timely tillage at the proper soil moisture content helps maintain structure. The main concern in management is protecting the soil from erosion during periods of occasional flooding. A plant cover helps reduce soil losses.

The potential is low for most urban uses. The flood hazard, moderate shrink-swell potential, and low strength are difficult to overcome. Major flood prevention measures and special engineering design are needed. Capability subclass IIw; Loamy Bottomland range site.

3—**Bunyan loam.** This is a deep, nearly level, well drained soil that is moderately permeable. It occurs as narrow to wide areas on smooth flood plains and is occasionally flooded for brief periods. Slopes are 0 to 1 percent.

In a representative profile the surface layer is dark yellowish brown, slightly acid loam 10 inches thick. The next 14 inches is yellowish brown, mildly alkaline fine sandy loam. The next 26 inches is grayish brown, moderately alkaline loam. The underlying material is yellowish brown, mildly alkaline loam.

Depth to bedrock is more than 72 inches. Available water capacity is high in the upper 40 inches.

About 15 percent of this map unit is included areas where the soil is reddish brown and dark reddish gray in the upper part but is otherwise similar to the Bunyan soil. About 5 percent is areas of Pulaski soils and about 5 percent areas of a soil that is similar to Bunyan but has a perched water table between depths of 3 and 5 feet. Also included are areas of a soil that is similar to this soil but is calcareous below a depth of 10 inches.

The potential is high for crops. Tame pasture, forage sorghum, and small grain are the chief crops. Grain sorghum, peanuts, and alfalfa hay are also grown.

The main concerns in management are flooding and soil structure. Returning crop residue contributes to good soil structure and intake of water. Minimum tillage is needed. A plant cover is needed during flooding late in fall and in spring to prevent excessive soil loss. The best protection is well managed tame pasture or woodland.

The potential is very low for urban use. Flooding is the main limitation. Major flood control is needed. Capability subclass IIw; Loamy Bottomland range site.

4—**Burleson clay, 0 to 1 percent slopes.** This deep, moderately well drained, nearly level soil occurs as broad smooth areas on uplands.

Typically, the upper 40 inches is dark gray and very dark gray, moderately alkaline clay. The next 13 inches is gray, moderately alkaline silty clay. The underlying layer is grayish brown, moderately alkaline silty clay.

This soil has moderate fertility and organic matter content. It is typically moderately alkaline throughout. Permeability is very slow, and the available water capacity is high. The soil has fair tilth but can be tilled within only a limited range of moisture content. The root zone is deep but difficult to penetrate.

About 10 to 20 percent of this map unit is included areas of Wilson and Heiden soils and areas where the surface layer is calcareous. Areas are generally less than 5 acres.

This soil is suited to hay and pasture. The potential is only medium for small grain and row crops. Tilth can be maintained or improved by returning crop residue. The erosion hazard is slight.

The potential is medium for most urban use because of the low strength and high shrink swell potential, which can be overcome only by special engineering design. The subsoil percolates slowly. The moisture level in the surface layer is at or near the field capacity from December through March in most years. Runoff is slow. Simple surface drains are used to remove excess water. Capability subclass IIw; Blackclay Prairie range site.

5—Chickasha loam, 1 to 3 percent slopes. This is a deep, very gently sloping, well drained soil that is moderately permeable. It occurs as narrow to wide areas on smooth upland ridge crests.

In a representative profile the surface layer is grayish brown, medium acid loam 12 inches thick. The upper 32 inches of the subsoil is reddish yellow, medium acid sandy clay loam. The lower 14 inches is reddish yellow, medium acid sandy clay loam and a few sandstone fragments. The underlying material is grayish sandstone mottled with reddish yellow. It is rippable (fig. 1).

This soil is medium in natural fertility and organic matter content. It is typically medium acid or slightly acid throughout. It has good tilth and can be worked throughout a wide range of moisture content. The available water capacity is high.

About 20 percent of this map unit is included areas of Zaneis soils, and 5 percent is areas of Renfrow soils. In a few areas the Chickasha soil has a fine sandy loam surface layer.

The potential is high for most crops in the county. The main crops are tame pasture plants, small grain, grain sorghum, peanuts, and forage sorghum. Range plants are also suitable.

Management is needed to maintain fertility and soil structure and to control the loss of soil through erosion. The cropping system should provide adequate amounts of residue. The risk of erosion can be reduced by farming on the contour, constructing terraces, and managing crop residue. A plant cover is needed in winter and spring. Fertilization increases plant growth and provides additional crop residue for erosion control. Terraces, contour farming, and cover crops are especially needed where row crops are grown. Excessive tillage should be avoided.

The potential is high for most urban uses. Low strength and depth to rock are limitations in developing some facilities. Capability subclass IIe; Loamy Prairie range site.

6—Chickasha loam, 3 to 5 percent slopes. This is a deep, gently sloping, well drained soil that is moderately permeable. It occurs as broad smooth areas on the crests and sides of upland ridges.

In a representative profile the surface layer is dark grayish brown, medium acid loam 12 inches thick. The upper 13 inches of the subsoil is yellowish brown, medium acid sandy clay loam. The lower 19 inches is reddish yellow, medium acid sandy clay loam. The underlying material is brownish yellow, partly weathered sandstone and thin interbedded layers of gray sandy clay loam. It is rippable.

This soil is medium in natural fertility and organic matter content. It is typically medium acid or slightly acid throughout. It can be easily worked throughout a wide range of moisture content. The available water capacity is high.

About 15 percent of this map unit is included areas of Zaneis soils. About 15 percent is areas of a soil that has a thicker surface layer and subsoil and reddish and grayish mottles in the lower part of the subsoil but is otherwise similar to this Chickasha soil. In a few areas the Chickasha soil has a fine sandy loam surface layer.

The potential is medium for tame pasture, native grass, and field crops, including peanuts, small grain, and grain or forage sorghum.

The main concerns in management are controlling erosion and maintaining fertility and soil structure. Terraces, contour farming, and crop residue are needed to control water erosion. Minimum tillage is essential. Rowcropping should be avoided unless small grain is a predominant part of the rotation. Tame pasture or native grass provides the best protection against erosion. Fertilization increases plant growth and provides additional crop residue.

The potential is high for most urban uses. Low strength and depth to rock are limitations for some uses. Capability subclass IIIe; Loamy Prairie range site.

7—Chickasha loam, 2 to 5 percent slopes, eroded. This is a deep, very gently sloping to gently sloping, well drained soil that is moderately permeable. It occurs as narrow to wide areas of smooth upland side slopes.

Part of the original surface layer has been removed by erosion from about half the acreage. In about 20 percent of the acreage, the surface layer and the upper part of the subsoil have been mixed by tillage. Rills caused by water erosion are common. A few gullies have formed.

In a representative profile the surface layer is brown, slightly acid loam 11 inches thick. The upper 21 inches of the subsoil is brown, medium acid and slightly acid sandy clay loam. The lower 16 inches is brownish yellow, slightly acid sandy clay loam. The underlying material is reddish yellow soft sandstone. It is rippable.

This soil is medium in natural fertility and low to medium in organic matter content. It is medium acid or slightly acid throughout the profile in most areas. It has fair to good tilth and can be easily worked throughout a wide range of moisture content. The available water capacity is high.

About 15 percent of this map unit is included areas of eroded Zaneis soils. About 5 percent is a soil that has more clay in the lower part of the subsoil but is otherwise similar to the Chickasha soil.

The potential is medium for tame pasture. In a few areas, the soil is cropped to small grain.

The main concerns in management are protecting the soil from accelerated erosion and maintaining fertility and soil structure. A cropping system of mostly small grain and an adequate amount of fertilizer are needed to provide maximum residue to control water erosion. Row crops should be avoided. Terraces, waterways, and con-

tour farming provide additional protection. Tame pasture grasses and fertilization reduce the hazard of soil erosion.

The potential is high for most urban use. Low strength and depth to bedrock are problems for some uses. Capability subclass IIIe; Loamy Prairie range site.

8—Chigley-Darnell Variant complex, 10 to 30 percent slopes. This unit consists of small areas of the Chigley soil and the Darnell Variant. These soils are so intermingled that they cannot be shown separately on the soil map. They occur as bands 150 to 350 feet wide on side slopes and foot slopes.

Chigley gravelly loam makes up 30 to 50 percent of the map unit. Typically, it has a pale brown, slightly acid gravelly loam surface layer about 2 inches thick. The subsurface layer is very pale brown, very strongly acid gravelly loam 4 inches thick. The subsoil is 36 inches of reddish yellow, medium acid or strongly acid clay. The underlying layer is hard fractured sandstone interbedded with hard shale and cherty conglomerate.

This soil is low in natural fertility and organic matter content. Permeability is moderately slow, and the available water capacity is high.

The Darnell Variant makes up 10 to 25 percent of the map unit. Typically, it has a pale brown, slightly acid channery loam surface layer about 5 inches thick. The subsoil is 12 inches of very pale brown, very strongly acid very channery clay loam. The underlying layer is channery sandstone interbedded with hard shale.

This soil is low in natural fertility and organic matter content. Permeability is moderately rapid, and the available water capacity is low.

About 25 to 45 percent of this map unit is included areas of a soil that has a thinner or thicker surface layer and subsoil and a higher percentage of gravel or coarse fragments but is otherwise similar to this Chigley soil. Outcrop of chert occurs in a few areas.

This unit of strongly sloping to steep soils is wooded. If it is cleared, erosion can be a severe hazard. The potential is very low for farming or tame pasture. Most areas are used for grazing. In some areas the gravelly bedrock is mined for use as roadbuilding material.

The potential is very low for urban development because of the strong unstable slopes, the intermingled shallow soils, and the high shrink-swell potential of the Chigley soil. Capability subclass VIIe; Chigley soil in Sandy Savannah range site, Darnell soil in Shallow Savannah range site.

9—Clarita silty clay, 3 to 5 percent slopes. This is a deep, gently sloping, moderately well drained soil that is very slowly permeable. It occurs on smooth upland hillsides. It formed under a cover of tall prairie grasses (fig. 2).

In a representative profile the upper 13 inches of the surface layer is very dark grayish brown, moderately alkaline silty clay. The lower 11 inches is dark brown, moderately alkaline silty clay. The next 21 inches is reddish brown, moderately alkaline silty clay. The underlying material also is reddish brown, moderately alkaline silty clay.

This soil is high in natural fertility and organic matter content. It is typically moderately alkaline throughout. Permeability is very slow, and the available water capacity is high. Tilth is fair. The soil can be tilled within only a limited range of moisture content.

About 20 to 25 percent of this map unit is included areas of Heiden, Tamford, and Renfrow soils, all of which are similar to the Clarita soil.

The potential is medium for row crops, small grain, pasture, and hay. Erosion is a hazard in cultivated areas. Minimum tillage, cover crops, high residue crops, grasses and legumes in the cropping system, and terraces reduce runoff and the risk of erosion.

The potential is medium for most urban use because of the low strength, high shrink-swell potential, and slow percolation. Special engineering design is needed. Capability subclass IIIe; Blackclay Prairie range site.

10—Dale silt loam. This is a deep, nearly level, well drained soil that is moderately permeable. It occurs as broad smooth terraces that are rarely or never flooded.

In a representative profile the upper 6 inches of the surface layer is brown, slightly acid silt loam. The lower 9 inches is brown, slightly acid silt loam. The subsoil is 39 inches of reddish brown, neutral silt loam. The underlying material is yellowish red, moderately alkaline silty clay loam.

Natural fertility, organic matter content, and available water capacity are high. Tilth is good.

About 5 percent of this map unit is included areas of Konawa fine sandy loam. In a few areas, the Dale soil has a loam surface layer. In most areas the potential is high for cultivated crops and tame pasture. The main crops are grain sorghum, small grain, alfalfa, cotton, and peanuts.

Management is needed to maintain fertility and soil structure. The cropping system should provide adequate amounts of residue. Tillage should be avoided when the surface layer is too moist.

The potential is medium for most urban use. Most factors are favorable. Flooding is rare, and then for only brief periods. Capability class I; Loamy Bottomland range site.

11—Durant loam, 1 to 3 percent slopes. This deep, moderately well drained, very gently sloping soil is on uplands. It occurs on broad smooth ridgetops and in broad smooth valleys.

Typically, the surface layer is dark gray, slightly acid loam 10 inches thick. The upper 6 inches of the subsoil is brown, slightly acid or mildly alkaline clay. The lower 30 inches is brownish yellow, moderately alkaline clay. The underlying material is reddish yellow, moderately alkaline clay with grayish mottles.

This soil is medium to high in natural fertility and organic matter content. It is typically medium acid or slightly acid in the surface layer and increases to moderately alkaline in the lower part of the subsoil. Permeability is very slow, and the available water capacity is high. The root zone is deep but is not easily penetrated by plant roots.

About 15 percent of this map unit is included areas of intermingled Normangee and Wilson soils.

The potential is medium for row crops, small grain, hay, and pasture. Tilth can be maintained or improved by returning ample crop residue to the soil. The erosion hazard is moderate if cultivated crops are grown. Erosion and runoff can be reduced by using terraces, contour farming, and minimum tillage; growing cover crops; and including grasses and legumes in the cropping system.

The potential is medium for most urban use. The clayey subsoil has low strength, high shrink-swell potential, and very slow percolation. Special engineering design is needed. Capability subclass IIe; Loamy Prairie range site.

12—Durant loam, 3 to 5 percent slopes. This is a deep, gently sloping, moderately well drained soil that is very slowly permeable. It occurs on smooth upland hillsides.

In a representative profile the surface layer is dark grayish brown, medium acid loam 10 inches thick. The upper 5 inches of the subsoil is dark grayish brown, medium acid clay loam. The next 40 inches is brown, slightly acid clay and grayish brown, moderately alkaline clay. The lower part of the subsoil is light olive brown, moderately alkaline clay (fig. 3).

This soil is high in available water capacity and medium to high in natural fertility. It has good tilth.

About 5 percent of this map unit is included areas of Normangee soils. About 5 percent is a soil that has a reddish brown subsoil but is otherwise similar to the Durant soil. Also included are small areas of Durant clay loam.

This Durant soil is used mostly as tame pasture and native range. The potential is medium for crops and pasture. A few areas are cropped to small grain or grain sorghum.

The main concerns in management are protecting the soil from erosion and maintaining soil structure and fertility. Terraces, contour farming, and crop residue are needed for erosion control if crops are grown. Minimum tillage is essential. Tame pasture or native grass is the best way to protect the soil from erosion.

The potential is medium for most urban use. The subsoil has low strength, high shrink-swell potential, and very slow percolation. Special engineering practices are needed. Capability subclass IIIe; Loamy Prairie range site.

13—Elandco clay loam. This is a deep, nearly level, well drained soil that is moderately permeable. It occurs as smooth, narrow to wide areas on flood plains. It is flooded occasionally for brief periods.

In a representative profile the upper 7 inches of the surface layer is grayish brown, mildly alkaline clay loam. The lower 9 inches is dark grayish brown, neutral silty clay loam. The next 16 inches is dark grayish brown, slightly acid silty clay loam. The next 16 inches is dark yellowish brown, neutral silty clay loam. The underlying material is brown, moderately alkaline silt loam.

This soil is high in natural fertility and organic matter content. It is nonacid throughout. It has good tilth if well managed. It can be tilled within only a narrow range of moisture content.

Depth to bedrock is more than 72 inches. Available water capacity is high.

About 10 percent of this map unit is included areas of Bergstrom soils. About 10 percent is a soil that has grayish or brownish mottles in the subsoil but is otherwise similar to this Elandco soil.

The potential is high for crops. Small grain, alfalfa, grain sorghum, forage sorghum, and tame pasture are the chief crops.

The main concerns in management are protecting the soil from erosion during periods of flooding and maintaining soil structure and fertility. The flood hazard is greatest in spring or fall. A plant cover is needed to reduce soil losses. Fertilization increases plant growth and the amount of crop residue. Minimum tillage and crop residue improve soil structure.

The potential is very low for most urban use. Occasional flooding is the major hazard. Major flood control measures are needed. The shrink-swell potential is moderate. Capability subclass IIw; Loamy Bottomland range site.

14—Eufaula fine sand, 5 to 15 percent slopes. This is a deep, gently sloping to moderately steep, somewhat excessively drained soil that is rapidly permeable. It occurs as narrow to wide areas on undulating to rolling upland ridge crests.

In a representative profile the surface layer is dark grayish brown, slightly acid fine sand 4 inches thick. The subsurface layer is pink, medium acid fine sand 51 inches thick. The next layer is pink, strongly acid fine sand and horizontal lamellae of reddish yellow, strongly acid loamy fine sand 1/8 inch to 2 inches thick.

This soil is low in natural fertility and organic matter content. Available water capacity is low in the upper 40 inches. Depth to bedrock is more than 72 inches.

About 10 percent of this map unit is included areas of soils that have a sandy surface layer 20 to 40 inches thick over a continuous subsoil of sandy clay loam. About 5 percent is areas of Konsil loamy fine sand.

The potential is medium for tame pasture and native pasture and very low for cultivated crops.

Management is needed to improve fertility and soil structure and to control the loss of soil through erosion. Tame pasture grasses should be fertilized and managed so that adequate plant growth and residue are left on the soil. Crop residue on the surface improves soil structure and reduces moisture losses caused by evaporation. Brush and weed control increases growth of pasture grasses. Tree covered areas used for grazing should be protected from uncontrolled burning.

The potential is medium for most urban use. The rapid percolation, the sandy texture, the susceptibility to erosion, and the strong slopes are limitations. Capability subclass VIe; Deep Sand Savannah range site.

15—Healdton silt loam. This deep, moderately well drained, nearly level soil is on broad smooth flood plains. It is subject to occasional flooding for brief periods.

Typically, the surface layer is light brownish gray, slightly acid silt loam about 6 inches thick. The upper 20 inches of the subsoil is dark gray, mildly alkaline and moderately alkaline silty clay. The lower 19 inches is brown, moderately alkaline silty clay. The underlying material is brown, moderately alkaline, massive silty clay.

This soil is low in natural fertility and organic matter content. It has a perched water table near the surface for short periods in winter and spring. Tilth is fair to poor. The clayey subsoil is not easily penetrated by plant roots. Permeability is very slow, and the available water capacity is high.

About 15 percent of this map unit is included areas of soils that have a reddish subsoil and a less clayey subsoil but are otherwise similar to the Healdton soil. About 5 percent is areas of Watonga soils.

The potential is low for small grain because of the high salt concentration near the surface, the slow surface drainage, and the very slow permeability. Tilth can be improved by returning crop residue.

Small grain, forage sorghum, and bermudagrass are commonly grown. Plants that grow during the cool season and are moderately to highly tolerant of sodium salts are successful. Simple surface drainage can remove water in some areas. Brief flooding is a hazard to crops in some years.

The potential is low for most urban use. Problems to be considered are occasional flooding, high shrink-swell potential, slow percolation, high corrosivity to steel, and seasonal surface wetness. Capability subclass IVs; Alkali Bottomland range site.

16—Heiden clay, 1 to 3 percent slopes. This deep, well drained, very gently sloping soil is on ridgetops and in swales. Slopes are smooth.

Typically, the surface layer is dark gray, mildly alkaline clay about 9 inches thick. The next 35 inches is dark grayish brown and grayish brown, moderately alkaline silty clay. The underlying material is light brownish gray, moderately alkaline silty clay mottled with olive yellow.

This soil is moderately high in natural fertility and organic matter content. Permeability is very slow, and the available water capacity is high. Tillage is limited to only a narrow range of moisture content.

About 10 to 20 percent of this map unit is included areas of intermingled Burleson, Wilson, and Clarita soils. Areas are less than 5 acres.

The potential is high for most row crops and small grain. It is medium for pasture and hay. Good tilth can be maintained by timely tillage and by returning ample crop residue. Erosion is a moderate hazard if crops are grown. Terraces, contour tillage, cover crops, and mulches of crop residue reduce runoff and the risk of erosion.

The potential is medium for most urban use. The soil has low strength, very slow percolation, and high shrink-swell potential throughout. Special engineering measures are needed. Capability subclass IIe; Blackclay Prairie range site.

17—Heiden clay, 5 to 12 percent slopes. This is a sloping or strongly sloping, well drained, very slowly permeable soil on uplands. It occurs as broad areas on gently rolling hills or smooth hillsides.

In a representative profile the surface layer is dark grayish brown, mildly alkaline clay 7 inches thick. The next 43 inches is grayish brown and light olive brown, moderately alkaline clay. The underlying material is light yellowish brown, moderately alkaline shaly clay.

This soil is moderately high in natural fertility and organic matter content. It has very slow permeability and a high content of available water.

About 20 percent of this map unit is included areas of soils that have pale olive or yellowish brown layers at depths of 4 to 12 inches but are otherwise similar to the Heiden soil. About 5 percent is areas of a soil that is similar to Heiden soil but has a clay loam surface layer. Another 5 percent is areas of a soil that is similar to this soil but has a surface layer and subsoil less than 40 inches thick.

This soil is used mostly for native pasture. In a few areas tame pasture has been established. The potential is medium for native grasses.

The main concern in management is protecting the soil from erosion, improving water intake, and maintaining soil structure and fertility. The soil is not generally suitable for cultivation. The quality of native grasses can usually be improved by proper grazing and by controlling weeds and protecting the pasture from fire. Fertilizing tame pasture increases the amount of forage, improves the quality of grass, and protects the soil from eroding.

The potential is only medium for most urban use because of the low strength, unstable slopes, and high shrink-swell potential. Special engineering measures are needed. Capability subclass VIe; Blackclay Prairie range site.

18—Kemp and Tullahassee soils. This map unit is about 45 percent the moderately well drained, moderately permeable Kemp soil and 25 percent the somewhat poorly drained, moderately rapidly permeable Tullahassee soil. These are nearly level to very gently sloping soils on flood plains that are subject to frequent flooding. Flooding usually occurs in spring and fall. The water table is only 2 to 3 feet below the surface most of the year.

In a representative profile of Kemp soil the surface layer is 6 inches of pale brown, slightly acid loam stratified with light brownish gray. The next 14 inches is pale brown, slightly acid loam. The next 28 inches is grayish brown, neutral loam mottled with brown. Below this to a depth of 72 inches is light gray, slightly acid silty clay loam mottled with brownish yellow.

Depth to bedrock is more than 72 inches. Available water capacity is high to a depth of 40 inches.

In a representative profile of Tullahassee soil the surface layer is 13 inches of pale brown, slightly acid loam that is stratified with grayish brown and very pale brown. The next 7 inches is pale brown, slightly acid fine sandy loam that is mottled with yellow and has thin

strata of brown and very pale brown. Below this is 20 inches of very pale brown, slightly acid loamy fine sand that is mottled with light brownish gray and has thin strata of pale brown and light brownish gray fine sandy loam. The underlying material to a depth of 65 inches is grayish brown, neutral loam that is mottled with light brown and gray and has thin strata of light brown.

Depth to bedrock is more than 72 inches. Available water capacity is moderate to a depth of 40 inches when the water table is below that depth.

About 15 percent of this map unit is included areas of a soil that has a dark grayish brown, grayish brown, or light gray surface layer but is otherwise similar to Tullahassee soil. About 10 percent is areas of Pulaski soils, and 5 percent areas of Bunyan soils.

The potential is high for grazing on both soils in this map unit. Tame pasture is established in some areas. The soils also support hardwoods and an understory of native grasses. They are not generally suitable for cultivation.

The main concerns in management are frequent flooding and soil drainage. Fertilization and proper grazing of tame pasture help to control the erosion caused by floodwater. Channel improvement is generally needed to improve soil drainage. Trees should be thinned and selectively harvested.

The potential is very low for most urban use. The high water table and frequent flooding are severe limitations. Capability subclass Vw; Subirrigated range site.

19—Kiti-Grainola complex, 5 to 20 percent slopes. This unit consists of intermingled areas of Kiti soil and Grainola soil. It occurs as narrow areas on convex ridgetops and dissected hillsides. It is sloping to moderately steep.

Kiti channery silty clay loam makes up 20 to 40 percent of each mapped area. Typically, it is dark grayish brown, moderately alkaline silty clay loam about 15 inches thick over hard fractured limestone. It is more than 35 percent channery and flaggy fragments of limestone.

This soil is high in natural fertility and organic matter content. It is moderately alkaline throughout. Permeability is moderate, and available water capacity is low. Depth to limestone bedrock is less than 20 inches. Most areas of Kiti soils are intermingled with areas of Rock outcrop.

Grainola gravelly clay loam makes up 20 to 30 percent of each mapped area. Typically, the surface layer is about 9 inches of reddish brown, calcareous, gravelly clay loam. The subsoil is 21 inches of reddish brown, calcareous clay. The underlying material is yellowish red and white, calcareous weathered shale.

This soil is moderate in natural fertility and organic matter content. It is moderately alkaline throughout. Permeability is slow, and the available water capacity is moderate.

About 10 to 20 percent of this map unit is included areas of soils that differ in color or percentage of coarse fragments but are otherwise similar to Kiti and Grainola. About 5 to 15 percent is intermingled areas of Rock outcrop.

This unit is not suitable for farming. The intermingled Rock outcrop, the shallowness over rock, and the strong slopes are limitations. The potential is medium for native grasses. The quality of native grasses can be maintained through proper grazing and by controlling weeds and protecting the pasture from fire. Grainola soils are subject to severe erosion unless protected by a good grass cover.

The potential is generally low for urban development. The shallow soil, the rocky surface, and the moderately steep slopes are problems that are difficult to overcome for most urban uses. Capability subclass VIIs; Kiti soil in Edgerock range site, Grainola soil in Shallow Prairie range site.

20—Kiti-Rock outcrop complex, 5 to 30 percent slopes. This unit consists of large, sloping to steep areas of Kiti soil and intermingled areas of limestone Rock outcrop. It occurs as narrow to wide areas on rocky ridgetops and rocky dissected hillsides.

Kiti channery silty clay loam makes up about 40 to 60 percent of each mapped area. Typically, it is dark grayish brown, moderately alkaline channery and very flaggy silty clay loam about 15 inches thick over hard fractured limestone. It is more than 35 percent channery and flaggy fragments of limestone.

This soil is high in natural fertility and organic matter content. It is neutral to moderately alkaline throughout. Permeability is moderate, and the available water capacity is low. Depth to limestone bedrock is 4 to 20 inches.

Rock outcrop of limestone makes up about 15 to 35 percent of each mapped area. It extends from a few inches to 3 feet above the soil surface. The extensive folding of the bedrock has created many different exposed patterns.

About 5 to 15 percent of this map unit is included areas where the soil is less than 35 percent limestone fragments and areas where it is clay throughout. These included soils are otherwise similar to Kiti soils. Also included are small areas of Heiden and Grainola soils.

This unit is not suitable for farming. The rock outcrop, the shallowness over rock and the slopes are limitations that are difficult to overcome. The potential is low for native grasses. Protection is needed from overgrazing and burning. Encroachment of brush and weeds is a problem in poorly managed areas.

The potential is very low for most urban use. The chief limitations are shallowness, the rock surface, and the steep slopes. Capability subclass VIIs; Kiti soil in Edgerock range site.

21—Konawa fine sandy loam, 0 to 1 percent slopes. This is a deep, nearly level, well drained soil that is moderately permeable. It occurs as broad smooth areas of high upland terraces.

In a representative profile the surface layer is pale brown, strongly acid fine sandy loam 12 inches thick. The upper 18 inches of the subsoil is yellowish red, medium acid sandy clay loam. The next 10 inches is reddish yellow, medium acid sandy clay loam. The lower 12 inches is reddish yellow, medium acid fine sandy loam. The underlying material is reddish yellow, medium acid, massive fine sandy loam.

This soil is moderate in natural fertility, organic matter content, and water holding capacity. It can be worked throughout a wide range of moisture content. The root zone is deep and is easily penetrated by plant roots.

About 10 percent of this map unit is included areas of Dale soils, and 5 percent areas of soils that have a more clayey lower subsoil but are otherwise similar to this soil.

The potential is high for small grain, grain sorghum, forage sorghum, peanuts, tame pasture, and hay. Crops generally respond well to applications of fertilizer.

Management is needed to maintain fertility and soil structure and to protect this soil from blowing. The cropping system should provide adequate amounts of residue. Cover crops should follow clean tilled crops. Depth of tillage should be varied and kept to a minimum.

The potential is high for most urban use. Seepage is severe if the soil is used for sewage lagoons or trench sanitary landfill. Capability class I; Sandy Savannah range site.

22—Konawa fine sandy loam, 1 to 3 percent slopes. This is a deep, very gently sloping, well drained soil that is moderately permeable. It occurs as broad smooth areas of high upland terraces.

In a representative profile the surface layer is brown, neutral (limed) fine sandy loam 10 inches thick. The upper 50 inches of the subsoil is reddish brown, medium acid sandy clay loam. The lower 12 inches is yellowish red, medium acid sandy clay loam.

This soil is moderate in natural fertility, water holding capacity, and organic matter content. It has a deep root zone and can be tilled throughout a wide range of moisture content. The response to fertilization is usually excellent.

About 5 percent of this map unit is included areas of Weatherford soils, about 5 percent areas of a soil that is similar to Konawa but has a more clayey subsoil, and about 5 percent areas of Konawa loamy fine sand.

The potential is high for small grain, forage sorghum, peanuts, and tame pasture.

Management is needed to maintain fertility and soil structure and to reduce soil losses through erosion. Adequate amounts of residue should be returned to the soil. Erosion can be reduced by contour farming and terraces. A cover crop or crop residue is essential in winter and spring to keep the soil from eroding. Excessive tillage should be avoided.

The potential is high for most urban use. Seepage is severe if this soil is used for sewage lagoons or trench sanitary landfill. Capability subclass IIe; Sandy Savannah range site.

23—Konawa fine sandy loam, 8 to 20 percent slopes. This is a deep, strongly sloping to moderately steep soil formed in loamy sediment on high terraces. It is on uplands. It occurs as a long narrow band between broad terraces of different elevations. Slopes are short, generally less than 300 feet. In some places they are smooth. In others they are dissected by small drainageways.

Konawa fine sandy loam makes up about 65 percent of each mapped area. Typically, it is brown, neutral fine sandy loam in the upper 6 inches. The subsurface layer is 7 inches of pale brown, neutral fine sandy loam. The upper 13 inches of the subsoil is reddish brown, neutral sandy clay loam. The next 24 inches is yellowish red, slightly acid sandy clay loam. The lower 22 inches is yellowish red, neutral fine sandy loam.

This soil is moderate in natural fertility, organic matter content, and available water capacity.

About 5 percent of this map unit is included areas of soils that have a 10- to 14-inch surface layer of dark grayish brown fine sandy loam over a reddish brown sandy clay loam subsoil. About 10 percent is areas of a soil that is similar to Konawa but has a fine sandy loam or silty clay loam subsoil. About 5 percent is areas of Konawa loamy fine sand. About 15 percent is areas where 12 to 24 inches of the original soil material has been removed by erosion.

This soil is generally not suited to farming. The potential is low for grasses. The native vegetation is scattered trees and an understory of tall grasses. Tame pasture has been established in some areas. The erosion hazard is severe unless the soil is protected by a permanent plant cover. Bermudagrass or native vegetation that is well managed provides the best protection from excessive erosion.

The potential is medium for most urban use. The slope and rapid percolation are limitations. Capability subclass VIe; Sandy Savannah range site.

24—Konsil loamy fine sand, 0 to 3 percent slopes. This is a deep, well drained, nearly level to very gently sloping soil on broad smooth uplands.

Typically, the plowed surface layer is pale brown, slightly acid loamy fine sand 8 inches thick. The subsurface layer is 6 inches of pale brown, medium acid loamy fine sand. The upper 26 inches of the subsoil is reddish yellow, medium acid sandy clay loam. The lower 25 inches is reddish yellow, medium acid fine sandy loam. The underlying material is reddish yellow, slightly acid loamy fine sand.

The organic matter content and natural fertility are low. Permeability and the available water capacity are moderate. The root zone is deep and is easily penetrated by roots. The shrink-swell potential is low. The soil can be worked throughout a wide range of moisture content.

About 5 percent of this map unit is included areas of Weatherford soils. About 5 percent is areas of a soil that is similar to the Konsil soils but has only yellowish brown or brownish yellow colors in the subsoil. About 10 percent is areas where the surface layer has been thinned by erosion.

The potential is medium for row crops, small grain, hay, and pasture. The main concerns in management are the moderate hazard of water erosion and soil blowing, the tilth, the fertility, and soil moisture.

Ample crop residue worked lightly into the surface, minimum tillage, and contour tillage reduce soil losses

through blowing and water erosion and help to conserve soil moisture and maintain tilth. Cover crops or grasses and legumes in the crop rotation also reduce the risk of erosion. Crops, pasture, and hay respond favorably to applications of fertilizer.

The potential is high for most urban use. The soil is sandy, however, and has low strength. Seepage is severe if it is used for sewage lagoons or trench sanitary landfill. Capability subclass IIIe; Deep Sand Savannah range site.

25—Konsil loamy fine sand, 3 to 8 percent slopes. This is a deep, well drained, gently sloping and sloping soil on broad smooth hillsides.

Typically, the surface layer is dark grayish brown, slightly acid loamy fine sand about 6 inches thick. The subsurface layer is 8 inches of pale brown, slightly acid loamy fine sand. The subsoil is 51 inches of reddish yellow, medium acid and slightly acid sandy clay loam. The underlying material is reddish yellow, slightly acid, massive fine sandy loam.

This soil is low in natural fertility and organic matter content. Permeability, shrink-swell potential, and the available water capacity are moderate. The soil can be tilled throughout a wide range of moisture content.

About 15 percent of this map unit is included areas of a soil similar to Konsil soil but the thickness of the surface layer and subsurface layer ranges from 20 to 45 inches. About 10 percent is areas of the similar Weatherford soils.

The potential is low for row crops. It is moderate for small grain or pasture. The erosion hazard is severe unless the soil is protected. Tame pasture grass or native grass is the best way to protect the soil from excessive erosion. If small grain or other sown crops are grown, high levels of crop residue should be left as a mulch and worked lightly into the surface layer. In some areas runoff should be diverted into terraces. Fertilization increases crop residue and forage of tame pasture grasses.

The potential is only moderate for most urban use because of the low strength, sandy surface layer, the slopes, and the seepage problem. Capability subclass IVe; Deep Sand Savannah range site.

26—Konsil and Weatherford soils, gullied. This unit consists of well drained, moderately permeable, very gently sloping to sloping soils. It occurs on uplands that have been gullied by water erosion.

Gullies 6 to 60 feet wide and 3 to 20 feet deep make up an average of 25 percent of the acreage. The percentage, however, ranges from as low as 15 in some areas to as high as 45 in others. About 40 percent of the unit is Konsil soil, 20 percent Weatherford soil, 10 percent Windthorst soil, and 5 percent Stephenville soil.

In a representative profile of the Konsil soil the surface layer is pale brown, slightly acid loamy fine sand 5 inches thick. The upper 45 inches of the subsoil is yellowish red, medium acid sandy clay loam. The lower 25 inches is reddish yellow, medium acid fine sandy loam with a few pink mottles.

Depth to bedrock is more than 60 inches. Available water capacity is moderate.

In a representative profile of the Weatherford soil the surface layer is pale brown, slightly acid fine sandy loam 5 inches thick. The subsoil is 43 inches of reddish yellow, medium acid sandy clay loam that is mottled in the lower part.

Depth to bedrock ranges from 40 to 60 inches. Available water capacity is moderate in the upper 40 inches.

The potential is medium for pasture and native range. Cultivated crops are generally not suited.

The main concern in management is protecting these soils from accelerated erosion and improving fertility and soil structure. In most areas runoff from higher areas should be diverted and the banks of gullies shaped before grasses can be established. Fertilizing tame pasture grass and legumes and controlling grazing improve soil structure and reduce the risk of erosion.

The potential is low for most urban use. The soils have low strength. Most areas are sandy. Gullies should be shaped, smoothed, and vegetated. Capability subclass VIe; Eroded Sandy Savannah range site.

27—Lawton Variant clay loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on smooth convex upland hillsides. Individual areas are generally 5 to 50 acres.

Typically, the surface layer is very dark grayish brown, neutral clay loam about 11 inches thick. The subsoil is more than 49 inches of a reddish brown, neutral to moderately alkaline clay.

This soil is high in natural fertility and organic matter content. Permeability is moderately slow, and the available water capacity is high. The shrink-swell potential of the subsoil is high.

About 15 to 22 percent of this map unit is included areas of soils that have a thinner surface layer, areas of a soil that has a brownish yellow lower subsoil but is otherwise similar to the Lawton soil, and a few intermingled areas of Clarita soils.

The potential is medium for row crops and small grain. It is also medium for pasture and hay.

The main concerns in management are controlling water erosion and maintaining soil structure and fertility. Terraces, contour farming, high residue crops, and cover crops reduce excessive erosion in cultivated areas. Returning crop residue helps to maintain soil structure and fertility. Tame pasture or native grass is the best way to control erosion.

The potential is medium for most urban use. The gentle slopes and the high shrink-swell characteristics of the subsoil should be considered in developing a facility. Capability subclass IIIe; Loamy Prairie range site.

28—Miller silty clay. This is a nearly level, moderately well drained, very slowly permeable soil on flood plains. It is occasionally flooded.

In a representative profile the surface layer is reddish brown, calcareous silty clay 24 inches thick. The next layer is 10 inches of brown, calcareous silty clay. The next 19 inches is reddish brown, calcareous silty clay. The underlying material is light reddish brown, calcareous clay loam.

This soil is high in natural fertility and organic matter content. Permeability is very slow, and the available water capacity is high. The soil has good tilth but can be tilled within only a narrow range of moisture content.

About 5 percent of this map unit is included areas of Elandco clay loam and about 5 percent areas of Weswood soils.

The potential is medium for most crops grown in the county. The main crops are small grain, grain sorghum, forage sorghum, alfalfa, and tame pasture.

The main concerns in management are the overflow hazard, the soil structure, and the slow runoff. Returning crop residue helps to improve soil structure. Surface drains generally are sufficient for improving runoff. Tillage should be timely and kept to a minimum.

The urban potential of this soil is low. Flooding is an occasional hazard, shrink-swell potential is high, and percolation is slow. Constructing flood control structures and designing facilities to overcome the high shrink-swell potential are needed. Capability subclass IIIw; Heavy Bottomland range site.

29—Miller soils. These are nearly level to very gently sloping, moderately well drained soils that are very slowly permeable. They occur on flood plains that are subject to frequent flooding. Slopes are 0 to 2 percent.

In a representative profile the surface layer is recent deposits 35 inches thick of reddish brown, calcareous silty clay with strata of dark reddish gray and reddish yellow. The next 10 inches is reddish brown, calcareous silty clay. Below this to a depth of 60 inches is brown, calcareous silty clay.

These soils are high in natural fertility and organic matter content. They are moderately alkaline throughout. Permeability is very slow, and the available water capacity is high. Shrink-swell potential is high.

About 20 percent of this map unit is included areas of similar soils that have a clay loam surface layer and underlying layer. Also included are small areas of ponded water.

The potential is medium for tame pasture. Flooding is too frequent for most field crops. A few areas are wooded.

The main concerns in management are flooding, surface wetness, slow water intake, and soil structure. Tame pasture grasses that can withstand frequent flooding are most productive. Sod seeding with small grain or other cool season grasses and legumes extends the grazing season and improves forage quality. When the soil is wet, tillage or grazing breaks down soil structure and reduces the water intake. In most areas, surface drainage reduces wetness.

The potential is low for most urban use. Flooding, surface wetness, and high shrink-swell potential severely limit the use of the soil for urban development. Special engineering design, major flood control measures, and surface drainage are needed. Capability subclass Vw; Heavy Bottomland range site.

30—Normangee loam, 2 to 5 percent slopes. This is a gently sloping, moderately well drained soil that is very slowly permeable. It occurs as broad areas on smooth upland side slopes and ridge crests.

In a representative profile the surface layer is dark grayish brown, slightly acid loam 8 inches thick. The upper 13 inches of the subsoil is brown, slightly acid clay with brownish mottles. The lower 24 inches is light yellowish brown, mildly alkaline clay with brownish mottles. The underlying layer is olive yellow, moderately alkaline clay with grayish mottles.

This soil is moderate in natural fertility and organic matter content. The available water capacity is high. The surface layer has fair tilth when moist but is hard or very hard when dry. The thin surface layer and clayey subsoil restrict normal root development of most plants.

About 10 percent of this map unit is included areas of Durant soils. About 5 percent is areas of a soil that is only 30 to 40 inches deep over sandstone but is otherwise similar to the Normangee soil.

The potential is low for grain sorghum and small grain. It is medium for native pasture or tame pasture.

The main concern in management is protecting the soil from erosion and maintaining or improving soil structure and fertility. The cropping system should provide adequate amounts of crop residue to improve soil structure and water intake. Fertilization helps to produce the maximum residue needed for controlling excessive water erosion. Row crops should be avoided to prevent excessive soil losses. Terraces, waterways, and contour farming help in protecting the soil. An adequate cover of tame pasture or native grass is the best way to reduce soil erosion.

The urban potential of this soil is moderate to high. The chief limitations are the slow percolation rates and the high shrink-swell characteristics of the subsoil. Most urban facilities can be designed to overcome these limitations. Capability subclass IVe; Claypan Prairie range site.

31—Normangee loam, 2 to 5 percent slopes, eroded. This is a very gently sloping or gently sloping, moderately well drained soil that is very slowly permeable. It occurs as broad areas on smooth upland side slopes.

Part of the original surface layer has been removed by erosion from about 60 percent of the area. In about 20 percent, the surface layer and upper part of the subsoil have been mixed by tillage. Rills and shallow gullies are common throughout the area.

In a representative profile the surface layer is 6 inches of grayish brown, slightly acid loam. The upper 21 inches of the subsoil is brown, medium acid clay with reddish mottles. The lower 28 inches is brown, moderately alkaline clay with brownish mottles. The underlying layer is brownish yellow, moderately alkaline clay with grayish mottles (fig. 4).

This soil is generally low in natural fertility and organic matter content. The available water capacity is high. Tilth is fair to poor. The surface layer is very hard or hard when dry. The dense subsoil severely limits root development.

About 10 percent of this map unit is included areas of Durant and Renfrow soils. About 20 percent is shallow gullies and other areas where the subsoil has been exposed by erosion.

This soil is used mainly for tame pasture, native grasses, small grain, grain sorghum, and forage sorghum. The potential is low for crops.

The main concern in management is protecting the soil from accelerated erosion and maintaining or improving fertility and soil structure. Small grain in the cropping system and adequate amounts of fertilizer in order to produce maximum residue help to control water erosion. Returning ample residue improves soil structure and water intake. Row crops should be avoided to prevent excessive loss of soil. Terraces, waterways, and contour farming are additional practices that protect the soil. Tame pasture grasses and legumes and additions of fertilizer are the best ways to reduce the risk of soil erosion.

The potential is low for most urban use. Slow percolation, thin layers of topsoil, and high shrink-swell potential in the subsoil are the most serious limitations for community development. Capability subclass IVe; Claypan Prairie range site.

32—Normangee clay loam, 2 to 5 percent slopes, severely eroded. This is a deep, very gently sloping to gently sloping, moderately well drained soil that is very slowly permeable. It is on uplands.

Part of the original surface layer has been removed by erosion from about 35 percent of the unit. In about 25 percent, the surface layer and upper part of the subsoil have been mixed by tillage. Gullies caused by water erosion are common. In about 25 percent of the unit the gullies are 8 feet to 35 feet wide and 1 foot to 2 feet deep. In about 15 percent, they are 3 feet to 6 feet deep.

In a representative profile the surface layer is 6 inches of brown, medium acid clay loam. The upper 6 inches of the subsoil is brown, slightly acid clay. The lower 42 inches is brownish yellow and reddish yellow, moderately alkaline clay.

This soil is low in natural fertility and organic matter content. The available water capacity is high. The dense clayey subsoil severely limits root development of most plants. The thin surface layer is crusty and hard or very hard when dry.

About 10 percent of this map unit is included areas of Durant and Renfrow soils. About 5 percent is areas of Chickasha soils.

This soil is generally no longer suited to cultivated crops. It is used mostly for tame pasture or native grasses. The potential is low for grasses.

The main concern in management is protecting the soil from accelerated erosion and improving fertility and soil structure. Fertilizing tame pasture and legumes for maximum residue helps to reduce the risk of further erosion. Runoff from higher areas should be diverted and banks of gullies shaped before establishing a permanent cover.

The potential is low to moderate for most urban use. The main limitations are gullied areas, slow percolation, high shrink-swell potential in the subsoil, and in much of the area, little or no topsoil. Most community facilities can be designed to overcome these limitations. Capability subclass VIe; Eroded Prairie range site.

33—Oil-Waste land. Oil-waste land consists of areas of accumulated liquid wastes, principally oil and saltwater. It is in most parts of the county that have oil and gas production. Areas range from about 5 acres up to 80 acres. Slopes are mostly 0 to 8 percent. Surface runoff is rapid, and erosion is a severe hazard.

Oil-waste land is unsuitable for farming. Some of it could be reclaimed, but the cost would be high. Diverting surface drainage from higher areas would be necessary. Rainwater could be impounded on the surface to help leach out soluble salts. A mulch of hay or straw would reduce evaporation and thus prevent the accumulation of salts on the surface.

Little vegetation grows on these areas. Salt-tolerant pasture plants could be grown if seeded in the middle of the rainy season, when the salt accumulation on the surface is reduced.

The urban potential is very low. Overcoming the high susceptibility to erosion and the corrosive effect of the salts is difficult. Smoothing, grading, and protection from overhead water are needed in most areas. Topsoil from nonaffected areas can then be spread on the surface and vegetation established. Capability subclass VIIIs; not assigned a range site.

34—Pits. Pits are mostly in areas of Kiti, Woodford, and Chigley soils, where fragments of limestone, chert, and sandstone have been excavated. A small acreage also occurs in the sandy and loamy areas of Yahola and Konawa soils, which provide base material for building roads, foundations, and similar structures.

The areas of Pits range from about 5 acres to 70 acres and are a few feet to 40 feet deep. They are of limited use for farming. Some support sparse to moderate amounts of vegetation and can be lightly grazed or used as wildlife habitat. Some contain water.

Pits are generally not suited to urban development. They are subject to flooding. Steep sides are common. Not assigned to a capability subclass or range site.

35—Pulaski fine sandy loam. This is a nearly level, well drained soil that is moderately rapidly permeable. It occurs as smooth narrow areas on flood plains that are occasionally flooded.

In a representative profile the surface layer is 8 inches of light grayish brown, medium acid fine sandy loam. The next 16 inches is reddish brown, medium acid fine sandy loam. The underlying layer is reddish yellow, medium acid fine sandy loam.

This soil is moderate in natural fertility and organic matter content. It has fair tilth and can be worked throughout a wide range of moisture content. The available water capacity is moderate. The water table is below 6 feet.

About 10 percent of this map unit is included areas of Bunyan soils, about 5 percent areas of Tullahassee soils, and 3 percent areas of Kemp soils.

The potential is high for crops. The soil is used mainly for tame pasture, peanuts, small grain, forage sorghum, and native grasses. It is suited to most crops commonly grown in the county.

The main concerns in management are flooding and maintaining soil structure. A heavy residue of crops or grasses is needed to protect the soil from excessive loss during periods of flooding. Well managed tame pasture or woodland provides the best protection. Returning crop residue and minimum tillage contribute to good soil structure and intake of water.

The urban potential of this soil is very low and is largely limited by occasional flooding. Major flood control measures are needed. Capability subclass IIw; Loamy Bottomland range site.

36—Pulaski and Bunyan soils. This unit consists of well drained, moderately rapidly permeable soils. These are nearly level to very gently sloping soils on flood plains that are subject to frequent flooding.

About 40 percent of this map unit is areas of Pulaski soil, 30 percent Bunyan soil, about 15 percent areas of Tullahassee and Kemp soils, about 10 percent areas of Elandco soil, and about 5 percent active stream channels or abandoned channels.

In a representative profile of the the Pulaski soil the surface layer is light brown, medium acid fine sandy loam 20 inches thick. The next 10 inches is light reddish brown, slightly acid fine sandy loam. The underlying material is reddish brown, slightly acid loam.

The available water capacity is moderate. Natural fertility and organic matter content are moderate.

In a representative profile of the Bunyan soil the surface layer is yellowish brown, neutral fine sandy loam 24 inches thick. The next 9 inches is brown, moderately alkaline clay loam. Below this layer is brown, moderately alkaline clay loam stratified with fine sandy loam.

The available water capacity is moderate or high. Natural fertility and organic matter content are moderate.

The potential is high for grasses and trees. The soils are used mainly for native grasses and tame pastures. They are not generally suitable for cultivation. A considerable acreage is wooded.

The main concern in management is the frequent flooding. These soils produce good quality hardwoods where trees are thinned, weeded, and selectively harvested. Pecan production is generally dependable under good management. Fertilizing and proper grazing of tame pasture are desirable practices to help control the erosion caused by flooding. Brush control is needed to obtain high forage yields.

The potential is very low for most urban use. The frequent flooding severely limits urban use. Because this unit is dissected by drainageways, extensive engineering and flood control measures are needed. Capability subclass Vw; Loamy Bottomland range site.

37—Renfrow silt loam, 1 to 3 percent slopes. This is a deep, well drained, very gently sloping soil on uplands. Slopes are smooth and convex.

Typically, the surface layer is reddish brown, slightly acid silt loam about 8 inches thick. The upper 4 inches of the subsoil is reddish brown, slightly acid clay loam. The lower part is reddish brown and red, mildly alkaline and moderately alkaline clay to a depth of 65 inches or more.

This soil is high in natural fertility and organic matter content. Permeability is very slow, and the available water capacity is high. Tilth is moderate.

About 25 percent of this map unit is included areas of soils that have more yellowish colors in the subsoil and areas of soils that have a surface layer and subsoil 40 to 60 inches thick but are otherwise similar to this Renfrow soil.

The potential is medium for row crops, small grain, hay, and pasture. Tilth can be maintained by returning crop residue to the soil. Erosion is a moderate hazard if cultivated crops are grown. Terraces, minimum tillage, high residue crops, and cover crops reduce runoff and help in erosion control.

The potential is medium to high for most urban use. Engineering design is needed to overcome the slow percolation rate and the high shrink-swell potential. Capability subclass IIIe; Claypan Prairie range site.

38—Renfrow silt loam, 3 to 5 percent slopes. This is a deep, well drained, gently sloping soil on uplands. Slopes are smooth and convex.

Typically, the surface layer is dark grayish brown, neutral silt loam about 11 inches thick. The upper few inches of the subsoil is reddish brown, neutral clay loam. The lower part to a depth of 60 inches or more is yellowish red and reddish brown, moderately alkaline clay.

This soil is high in natural fertility and organic matter content. Permeability is very slow, and the available water capacity is high.

About 25 percent of this map unit is included areas of soils that are similar to this Renfrow soil but have a surface layer and subsoil 40 to 60 inches thick, a brown or yellowish brown subsoil, or a dark colored surface layer less than 10 inches thick. These included soils occur as intermingled areas of less than 5 acres within larger areas of Renfrow soils.

The potential is low for field crops. The soil is used mostly for tame pasture, small grain, and native range.

The main concerns in management are protecting the soil from erosion and maintaining soil structure and fertility. Row crops are generally not grown. If they are grown, terraces, contour farming, high levels of crop residue, and minimum tillage help to control excessive erosion. Tame pastures or native grasses are the best protection against erosion. Most crops respond to fertilization.

The urban potential is generally medium. The high shrink-swell potential of the subsoil and moderate slopes are factors to be considered in developing facilities. Capability subclass IVe; Claypan Prairie range site.

39—Scullin-Kiti complex, 1 to 8 percent slopes. This unit consists of well drained, moderately permeable and moderately slowly permeable soils. These soils occur as

narrow to wide, smooth to gently undulating areas on the crests and sides of upland ridges.

About 50 percent of this map unit is Scullin soil, 25 percent Kiti soil, 12 percent the Lawton Variant, 10 percent Heiden soils, and about 3 percent limestone outcrop.

In a representative profile of the Scullin soil the surface layer is grayish brown, slightly acid clay loam 11 inches thick. The upper 7 inches of the subsoil is reddish brown, slightly acid clay loam. The next 10 inches is reddish brown, slightly acid clay. The lower 6 inches is reddish brown, moderately alkaline flaggy clay. Below this is hard fractured limestone.

Depth to limestone is 20 to 40 inches. Available water capacity is medium.

In a representative profile of the Kiti soil the surface layer is grayish brown, mildly alkaline channery silty clay loam 7 inches thick. The subsurface layer is grayish brown, mildly alkaline flaggy silty clay loam 10 inches thick. The underlying material is highly fractured hard limestone.

Depth to bedrock ranges from 4 to 20 inches. The available water capacity is low.

The potential is medium for grasses. This unit, however, is used mainly for grazing. A few areas have been established in tame pasture.

The main concerns in managing tame pasture are the shallowness of the soil over rock and the scattered rock outcrop. The quality of native grass can be maintained or improved by proper grazing, protecting the pasture from fire, and controlling weeds and scattered brush. Fertilizing tame pasture increases production and improves the quality of grass. A few areas are too rocky for establishing tame pasture. This unit is generally not suitable for cultivation.

The potential is low to medium for most urban use because the Kiti soil is shallow over rock and the Scullin soil is only moderately deep. Additional limitations in the Scullin soil are the moderate to high shrink-swell potential and the slow percolation rate. Capability subclass VIe; Scullin soil in Loamy Prairie range site, Kiti soil in Edgerock range site.

40—Steedman clay loam, 5 to 20 percent slopes. This is a moderately deep, sloping to moderately steep, moderately well drained soil that is slowly permeable. It occurs on smooth, rolling upland hillsides.

In a representative profile the surface layer is grayish brown, neutral clay loam 4 inches thick. The upper 7 inches of the subsoil is brown, slightly acid clay. The next 14 inches is olive, neutral clay. The lower 11 inches is pale olive, moderately alkaline clay. The underlying material is laminated layers of shale and shaly clay.

This soil is low in fertility and organic matter content. The available water capacity is medium. Depth to bedrock or shale or shaly clay is 20 to 40 inches.

About 15 percent of this map unit is included areas of soils that are 40 to 60 inches deep but are otherwise similar to this Steedman soil. About 5 percent is areas of Heiden soils, and about 5 percent is areas of soils that have a thicker surface layer but are otherwise similar to this soil. There are also small areas of Rock outcrop.

The potential is low for grasses. This soil, however, is used mostly for native range or tame pasture. The quality of grasses can be maintained or improved by using suitable grazing practices, providing protection from fire, and controlling brush and weeds.

The potential is low to medium for most urban use. The moderate depth, high shrink-swell potential, slow percolation, and strong slopes are features that are difficult to overcome for some urban facilities. Capability subclass VIe; Loamy Prairie range site.

41—Stephenville-Darnell complex, 2 to 8 percent slopes. This unit consists of the well drained, moderately permeable Stephenville soil and the well drained, moderately rapidly permeable Darnell soil. These very gently sloping to sloping soils are on upland ridge crests.

The unit is in a mixed pattern of 55 percent Stephenville soil, 20 percent Darnell soil, 10 percent Windthorst soil, and 5 percent Weatherford soil.

In a representative profile of the Stephenville soil the surface layer is brown, slightly acid fine sandy loam 6 inches thick. The subsurface layer is pale brown, slightly acid fine sandy loam 6 inches thick. The upper 8 inches of the subsoil is reddish brown, medium acid sandy clay loam. The lower 5 inches is reddish brown, medium acid gravelly sandy clay loam. The underlying material is soft rippable sandstone.

Depth to sandstone is 20 to 40 inches. The available water capacity between depths of 20 and 40 inches is low to medium.

In a representative profile of the Darnell soil the surface layer is brown, slightly acid fine sandy loam 6 inches thick. The subsoil to a depth of 13 inches is reddish brown, slightly acid loam. The underlying material is a rippable sandstone similar in color and reaction to the subsoil (fig. 5).

Depth to sandstone ranges from 10 to 20 inches. The available water capacity is low.

About 10 percent of this map unit is included areas of soils that are similar to the Darnell soil in thickness but have a sandy clay or sandy clay loam subsoil. Also included are small areas of rock outcrop.

The soils in this unit are low in natural fertility and organic matter content. The surface layer is medium acid or slightly acid unless limed. The shrink-swell potential is low.

The soils in this unit are mainly used for native grass and tame pasture. They also support some hardwoods. The potential is only medium for grass.

The main concerns in management are slope and erosion and the shallowness over sandstone of the Darnell soil. This unit is not generally suitable for cultivation. The quality of native grass can be maintained or improved by proper grazing, controlling brush, and protecting the pasture from fire. Fertilizing tame pasture increases production, improves the quality of the grass, and protects the soil from eroding. The shallowness and the rock

outcrop limit the use of certain types of machinery in managing tame pasture.

The potential is low or medium for most urban use because the soils are shallow and only moderately deep over bedrock. Capability subclass VIe; Stephenville soil in Sandy Savannah range site, Darnell soil in Shallow Savannah range site.

42—Tamford-Grainola complex, 5 to 12 percent slopes. This unit consists of well drained, very slowly and slowly permeable soils. These sloping to strongly sloping soils occur on the crests and sides of ridges on uplands.

The unit is about 40 percent Tamford soil, which is mostly on foot slopes and side slopes; 30 percent Grainola soil, which is on ridge crests and the upper part of side slopes; 20 percent soils that are similar to the Tamford soil but have a darker colored surface layer; and 5 percent soils that are similar to the Grainola soil but have a thicker dark brown surface layer.

In a representative profile of the Tamford soil the surface layer is reddish gray, slightly acid clay loam 6 inches thick.

The subsoil to a depth of 54 inches is reddish brown, moderately alkaline clay. It is calcareous in the lower part. The underlying material is red, moderately alkaline, massive clay.

The soil is 40 to 60 inches deep. The available water capacity is high. Natural fertility and organic matter content are moderate.

In a representative profile of the Grainola soil the surface layer is reddish brown, moderately alkaline clay loam 3 inches thick. The subsoil to a depth of 32 inches is reddish brown and weak red, moderately alkaline clay. The underlying material is massive, calcareous clay (fig. 6).

This soil is 20 to 40 inches deep. The available water capacity is moderate. Natural fertility is moderate, and organic matter content is low. The upper part of the soil is mildly or moderately alkaline. The shrink-swell potential is high.

About 5 percent of this map unit is included areas of soils that are less than 20 inches deep but are otherwise similar to the Grainola soil. Also included are small areas of Rock outcrop.

The potential is low for grass, but the soils are used mainly for native grass. A few areas are in tame pasture.

The main concerns in management are slopes, hazard of erosion, droughtiness, and maintaining soil structure and fertility. This complex is not generally suitable for cultivation. The quality of native grass can usually be improved by proper grazing, controlling weeds, and protecting pasture from fire. Fertilizing tame pasture increases the amount of forage, improves the quality of grass, and protects the soil from eroding.

The potential is low or moderate for most urban use. The main limitations are high shrink-swell potential, strong slopes, and intermingled areas of shallow to moderately deep soils. Capability subclass VIe; Tamford soil in Redclay Prairie range site, Grainola soil in Shallow Prairie range site.

43—Watonga silty clay. This deep, moderately well drained, nearly level soil occurs as broad smooth areas on flood plains near large streams. It is occasionally flooded.

Typically, the surface layer is dark gray silty clay about 24 inches thick. The next 31 inches is dark grayish brown silty clay. Below this layer is brown silty clay.

This soil is high in natural fertility and organic matter content. It is neutral to moderately alkaline in the upper part. Permeability is very slow, and the available water capacity is high. The soil has fair tilth but can be tilled within only a narrow range of moisture content.

About 15 percent of this map unit is included areas of intermingled soils that have more reddish colors at depths of 20 to 40 inches and areas of soils that are similar to this soil but have thin strata of loam or clay loam in the upper 40 inches. About 10 percent is included areas of Bergstrom clay loam.

The potential is medium for row crops, small grain, pasture, and hay. The potential is limited because of tillage and problems caused by flooding and surface drainage. Tilth can be maintained by returning crop residue to the soil. Surface drainage improves runoff during periods of high rainfall.

The potential is very low for urban use. The soil is severely limited by the occasional flood hazard. Other problems are the high shrink-swell potential and the slow percolation rate. Capability subclass IIIw; Heavy Bottomland range site.

44—Weatherford fine sandy loam, 1 to 3 percent slopes. This deep, well drained, very gently sloping soil occurs as narrow to wide areas on ridgetops. Slopes are smooth and convex.

Typically, the surface layer is grayish brown, slightly acid fine sandy loam about 6 inches thick. The subsurface layer is pale brown, slightly acid fine sandy loam about 2 inches thick. The subsoil to a depth of 50 inches is yellowish red and reddish yellow, medium acid sandy clay loam. The underlying material is soft sandstone.

In most areas natural fertility and organic matter content are low. Permeability is moderate, and the available water capacity is moderate. This soil can be easily worked throughout a wide range of moisture content.

About 10 percent of this map unit is included areas of Windthorst soils, about 10 percent Stephenville soils, and about 10 percent soils that have a yellowish brown or brownish yellow subsoil but are otherwise similar to Weatherford soils.

This soil is well suited to row crops and small grain. Its potential is high, and high yields can be obtained. The potential is also high for pasture and hay.

Tilth can be maintained by returning crop residue to the soil. Erosion is a hazard if cultivated crops are grown. Minimum tillage, contour tillage, cover crops, and terraces reduce runoff and the risk of erosion. Tame pasture grasses provide the best protection against soil erosion. Fertilization is needed for high yields and maximum crop residue.

The potential is high for most urban use. The 40- to 60-inch depth over bedrock is a limitation for some urban use. Capability subclass IIe; Sandy Savannah range site.

45—Weatherford fine sandy loam, 3 to 5 percent slopes. This is a gently sloping, well drained soil that is moderately permeable. It occurs as broad smooth areas of upland ridge crests and side slopes.

In a representative profile the surface layer is grayish brown, neutral fine sandy loam 5 inches thick. The subsurface layer is 6 inches of light yellowish brown, slightly acid fine sandy loam. The upper 26 inches of the subsoil is yellowish red, neutral sandy clay loam. The lower 7 inches is reddish yellow, slightly acid fine sandy loam. The underlying layer is reddish yellow, slightly acid soft sandstone.

Depth to bedrock is 40 to 60 inches. Permeability is moderate. The available water capacity is medium. The soil is medium acid to neutral in the upper part. It has good tilth, is easily worked, and has a deep root zone.

About 10 percent of the acreage is included areas of Stephenville fine sandy loam and about 5 percent is areas of Windthorst fine sandy loam.

The potential is medium for field crops and high for grasses. Tame pasture, native range, peanuts, grain sorghum, and small grain are the main crops.

Controlling erosion and maintaining fertility and soil structure are the main management problems. Terraces, contour farming, and crop residue are needed to control erosion when crops are grown. Crop residue returned to the soil and minimum tillage are essential. Rowcropping should be avoided unless small grain is predominant in the rotation to protect the soil from water erosion. Addition of fertilizer on pasture grasses and legumes or native grass is the best way to protect the soil from eroding.

The potential is high for most urban use. For facilities that require excavations, the rippable sandstone at depths of 40 to 60 inches must be considered. Capability subclass IIIe; Sandy Savannah range site.

46—Weatherford fine sandy loam, 2 to 5 percent slopes, eroded. This deep, well drained, very gently sloping or gently sloping, eroded soil is on smooth convex ridgetops and hillsides.

Erosion has removed 50 to 85 percent of the original surface layer from about 60 percent of the map unit. Shallow rills and a few deep gullies make up about 25 to 50 percent of the acreage.

Typically, the plow layer is reddish brown, slightly acid fine sandy loam about 4 inches thick. The subsoil is red, slightly acid and neutral sandy clay loam that extends to about 58 inches. The underlying material is a soft weakly cemented sandstone.

This soil is low in natural fertility and organic matter content. It has fair tilth, is moderately permeable, and has medium available water capacity.

About 10 percent of this map unit is included areas of Stephenville soils, 5 percent Windthorst soils, 5 percent Konsil soils, and about 5 percent areas of soils that have a yellowish brown or brownish yellow subsoil but are otherwise similar to Weatherford soil.

The potential is low for row crops. It is medium for small grain or hay and pasture.

Erosion is a hazard if crops are grown. Intensive use of crop residue, cover crops or grasses or legumes in the crop rotation, terraces, and contour tillage reduce erosion losses. Tame pasture grasses can prevent excessive erosion. Applying adequate amounts of fertilizers increases crop residue and improves the soil cover when tame pasture grasses are grown.

The potential is high for most urban use. The 40- to 60-inch depth to bedrock requires additional design for sanitary facilities. Capability subclass IIIe; Sandy Savannah range site.

47—Weatherford-Duffau complex, 3 to 8 percent slopes. This unit is 45 percent Weatherford soil and 30 percent Duffau soil. These are well drained, moderately permeable, gently sloping and sloping soils on the side slopes of uplands. They occur in a mixed pattern. The Weatherford soil is mostly on the upper parts of side slopes, and the Duffau soil is on the lower parts, or foot slopes.

In a representative profile of the Weatherford soil the surface layer is brown, slightly acid fine sandy loam 6 inches thick. The subsurface layer is 5 inches of pale brown, slightly acid fine sandy loam. The subsoil to a depth of 56 inches is yellowish red and reddish yellow, slightly acid sandy clay loam. The underlying layer is weakly cemented sandstone.

Depth to sandstone is 40 to 60 inches. The available water capacity is medium to a depth of 40 inches.

In a representative profile of the Duffau soil the surface layer is brown, slightly acid fine sandy loam 9 inches thick. The subsurface layer is 6 inches of pale brown, slightly acid fine sandy loam. The upper 17 inches of the subsoil is yellowish red, mildly alkaline sandy clay loam. The next 12 inches is yellowish red, neutral sandy clay loam with a few reddish brown mottles. The lower 22 inches is reddish yellow, slightly acid sandy clay loam with common pink and red mottles. The underlying material is weakly consolidated sandstone.

Depth to sandstone is 60 to about 80 inches. The available water capacity is medium to a depth of 40 inches. The soil is low in natural fertility and organic matter content. It has fair tilth, is easily worked, and has a deep root zone.

About 10 percent of this map unit is included areas of Stephenville soils, 10 percent soils that are similar to Weatherford soil but have grayish mottles, and 5 percent areas of Windthorst soils.

The potential is low for small grain and is medium for native grasses and tame pasture. The soils support low quality hardwoods and in some areas an understory of native grasses.

The main concerns in management are the slope, the hazard of erosion, the structure, and the fertility. Controlling brush is an additional concern. A cropping system that provides mostly small grain and adequate amounts of fertilizer is needed to control water erosion. Row crops

should be avoided. Terraces, waterways, and contour farming are additional practices that protect the soil from eroding. Managing native grasses or tame pasture grasses with additions of fertilizer is the best way to reduce soil erosion.

The potential is medium or high for most urban use. The limiting factors for some uses are the slopes of 3 to 8 percent and the rippable sandstone bedrock at 40 to 60 inches in the Weatherford soil. Capability subclass IVe; Sandy Savannah range site.

48—Weswood silt loam. This is a deep, nearly level, well drained soil that is moderately permeable. It occurs on flood plains as narrow to wide areas along streams. It is occasionally flooded.

In a representative profile the surface layer is light brown, moderately alkaline silt loam 6 inches thick. Below this to a depth of 80 inches or more is light brown, stratified, moderately alkaline silt loam.

The soil is 30 to 60 inches thick. It is high in natural fertility and has moderate organic matter content. The available water capacity of the upper 40 inches is high.

About 5 percent of this map unit is included areas of soils that have a dark brown surface layer but are otherwise similar to the Weswood soil. About 5 percent is areas of soils that are similar but have a more sandy surface layer and underlying layers.

The potential is high for most commonly grown crops. The main crops are small grain, alfalfa, forage sorghum, and tame pasture.

Management is needed to maintain fertility and soil structure. Flooding is a hazard in most years. Cropping systems should provide adequate amounts of residue. Excessive tillage should be avoided.

The potential is very low for urban development because of the occasional flood hazard. Major flood control measures are needed. Capability subclass IIw; Loamy Bottomland range site.

49—Wilson silt loam, 0 to 1 percent slopes. This deep, somewhat poorly drained, nearly level soil is on broad smooth upland prairies.

Typically, the surface layer is gray, medium acid silt loam about 8 inches thick. The upper 18 inches of the subsoil is very dark gray, neutral silty clay. The next 26 inches is grayish brown, moderately alkaline silty clay. The lower 54 inches is reddish yellow, moderately alkaline clay with grayish and yellowish mottles.

This soil is moderate in natural fertility and organic matter content. Permeability is very slow. The surface layer is massive and hard when dry. The available water capacity is high. The clayey subsoil is not readily penetrated by plant roots.

About 10 percent of this map unit is included areas of soils that are similar to this Wilson soil but have a light colored subsurface layer only 1 to 3 inches thick. About 5 percent is included areas of Renfrow soils and 5 percent Durant soils.

The potential is high for row crops, small grain, pasture, and hay. The surface layer tends to become massive and hard when dry. Tilth is improved when high levels of crop residue are returned to the soil. Minimum tillage and timely tillage help maintain tilth and reduce compaction. In some areas terraces are needed to help remove excess surface water during periods of high rainfall.

The potential is medium for most urban use. The high shrink-swell factor, surface drainage, and surface wetness in spring and fall can limit some urban uses unless facilities are designed to overcome those limitations. Capability subclass IIs; Claypan Prairie range site.

50—Wilson silt loam, 1 to 3 percent slopes. This is a very gently sloping, somewhat poorly drained, very slowly permeable soil. It occurs as broad areas on the smooth sides and crests of upland ridges.

In a representative profile the surface layer is dark grayish brown, medium acid silt loam 8 inches thick. The upper 20 inches of the subsoil is dark gray, slightly acid clay. The next 14 inches is grayish brown, neutral clay. The lower 18 inches is brown, moderately alkaline clay with grayish brown mottles (fig. 7).

This soil is moderate in natural fertility and organic matter content. Permeability is very slow. Available water capacity is high. Shallowness over the dense clay subsoil limits the normal root development of most crops. The surface layer is massive and very hard when dry.

About 10 percent of this map unit is included areas of Normangee soils and 5 percent areas of Durant soils.

This soil is used for grain sorghum or forage sorghum, small grain, tame pasture, and native range. The potential is medium for field crops and grasses.

Management is needed to maintain fertility and soil structure and to control the loss of soil through erosion. The cropping system should provide adequate amounts of residue. The risk of erosion can be reduced by contour farming, terraces, and crop residue. A plant cover is needed in winter and spring. Fertilization increases plant growth and provides additional crop residue. Terraces, contour farming, and cover crops are especially needed where row crops are grown.

The potential is medium for most urban use. The chief limitations are the high shrink-swell potential and the slow percolation rate. Capability subclass IIIe; Claypan Prairie range site.

51—Windthorst fine sandy loam, 1 to 3 percent slopes. This is a deep, very gently sloping, moderately well drained soil that is moderately slowly permeable. It occurs as broad smooth areas on upland ridge crests.

In a representative profile the surface layer is grayish brown, slightly acid fine sandy loam 5 inches thick. The subsurface layer is 6 inches of very pale brown, medium acid fine sandy loam. The upper 14 inches of the subsoil is reddish brown, medium acid clay. The next 9 inches is light yellowish brown, mildly alkaline clay with a few brownish yellow mottles. The lower 20 inches is brownish yellow, moderately alkaline clay with common pale brown mottles. The underlying material is brownish yellow, moderately alkaline sandy clay.

This soil is generally low in natural fertility and organic matter content. The available water capacity is medium or high.

About 5 percent of this map unit is included areas of soils that are brown or yellowish brown in the upper part of the subsoil but are otherwise similar to the Windthorst soil. About 5 percent is areas of soils that are similar to the Windthorst soil but are sandy clay loam in the upper part of the subsoil.

This soil is used for tame pasture, small grain, forage sorghum, grain sorghum, and native grasses. The potential is high for field crops and grasses.

Management is needed to maintain fertility and soil structure and to control the loss of soil through water erosion. A cropping system that provides adequate amounts of residue is needed. The risk of erosion can be reduced by using contour farming and terraces and by managing crop residue. A plant cover or crop residue is needed in fall and spring to keep the soil from eroding. Fertilization increases plant growth and provides additional crop residue. Terraces, contour farming, and cover crops are especially needed where row crops are grown. Excessive tillage should be avoided.

The potential is medium or high for most urban use. The main limitations are the moderate or high shrink-swell potential in the subsoil, the slow percolation rate, and the low strength. Most facilities can be designed to overcome these limitations. Capability subclass IIe; Sandy Savannah range site.

52—Windthorst fine sandy loam, 3 to 5 percent slopes. This is a deep, gently sloping, moderately well drained soil that is moderately slowly permeable. It occurs as narrow to wide, smooth, convex areas on upland hillsides.

In a representative profile the surface layer is brown, medium acid fine sandy loam about 3 inches thick. The subsurface layer is light brown, medium acid fine sandy loam about 4 inches thick. The upper 13 inches of the subsoil is reddish brown, medium acid sandy clay. The next 19 inches is light yellowish brown, neutral clay. The lower 15 inches is very pale brown, moderately alkaline sandy clay with brownish gray mottles. The underlying material is soft shale interbedded with sandstone.

This soil is generally low in natural fertility and organic matter content. The available water capacity is high.

About 25 percent of this map unit is included areas of similar soils that are slightly more acid in the lower part of the solum. About 10 percent is areas of soils that have only 3 to 5 inches of sandy clay loam in the upper part of the subsoil but are otherwise similar to this soil.

The potential is low for row crops. It is medium for small grain, hay, and pasture.

Tilth can be maintained by returning crop residue to the soil. The erosion hazard is moderate if cultivated crops are grown. Terraces, contour farming, minimum tillage, and residue management are ways to help reduce runoff and the risk of erosion. Fertilization produces higher yields of most crops.

The potential is medium or high for most urban facilities. The chief limitations are the moderate to high shrink-swell potential of the subsoil, the low strength, and the slow percolation rate. Capability subclass IIIe; Sandy Savannah range site.

53—Windthorst fine sandy loam, 2 to 5 percent slopes, eroded. This is a deep, very gently sloping to gently sloping, moderately well drained soil that is moderately slowly permeable and moderately eroded. It occurs as narrow to wide, smooth convex areas on uplands.

Shallow gullies and a few deep gullies have formed. In most areas erosion has removed 30 to 75 percent of the original surface layer. In about 25 percent of the areas, the subsoil is exposed.

In a representative profile the plow layer is pale brown, slightly acid fine sandy loam about 5 inches thick. The upper 21 inches of the subsoil is yellowish red, medium acid sandy clay. The next 12 inches is reddish yellow, moderately alkaline sandy clay with brownish and grayish mottles. The underlying material is massive, moderately alkaline sandy clay interbedded with soft sandstone.

This soil is low in natural fertility and organic matter content. The available water capacity is high.

About 20 percent of this map unit is included areas of soils that are similar to the Windthorst soil, but the upper part of the subsoil is sandy clay loam that is brownish yellow or light yellowish brown or has grayish mottles.

The potential is low for row crops but is medium for small grain, pasture, and hay.

The main concerns in management are controlling erosion and improving soil structure and fertility. Additional erosion can be retarded by terraces, contour farming, grasses and legumes in the crop rotation, high residue crops, and cover crops. Ample crop residue and minimum tillage improve soil structure and fertility. Tame pasture grass is the best way to protect the soil from eroding.

The potential is moderate for urban use. The slow percolation rate, the high or moderate shrink-swell potential, the low strength, and the limited topsoil reduce the suitability for most urban use. All of these limitations can be easily overcome by careful design. Capability subclass IIIe; Sandy Savannah range site.

54—Windthorst-Darnell complex, 5 to 20 percent slopes. This unit consists of the deep, moderately well drained Windthorst soil and the shallow, somewhat excessively drained Darnell soil. These sloping to moderately steep soils are on ridge crests and hillsides.

The unit is about 35 percent Windthorst soil, 26 percent Darnell soil, 18 percent sandstone rock outcrop, and 5 percent Weatherford soil.

In a representative profile of the Windthorst soil the surface layer is pale brown, neutral loam about 3 inches thick. The upper 12 inches of the subsoil is yellowish red, medium acid clay. The next 16 inches is light yellowish brown, medium acid clay. The lower part of the subsoil is pale brown, mildly alkaline clay loam. The underlying

material is massive, grayish, moderately alkaline clay loam interbedded with layers of sandstone.

This soil is generally low in natural fertility and organic matter content. Permeability is moderately slow, and the available water capacity is high. The shrink-swell potential in the subsoil is medium to high.

In a representative profile of the Darnell soil the surface layer is grayish brown, neutral fine sandy loam about 2 inches thick. The subsurface layer is 4 inches of pale brown, slightly acid fine sandy loam. The subsoil is 10 inches of very pale brown, slightly acid fine sandy loam. The underlying material is soft sandstone.

This soil is generally low in natural fertility and organic matter content. Permeability is moderately rapid, and the available water capacity is low.

About 16 percent of this map unit is included areas of soils that have a thinner surface layer and subsoil or a clayey surface layer but are otherwise similar to the Windthorst soil.

The potential is low for tame pasture. The large stones, rock outcrop, shallowness, and slope are limitations (fig. 8). Erosion is a severe hazard in cleared areas.

Most areas under a cover of low quality hardwoods are used for native grasses. A few areas that have been cleared of brush and trees are established to tame pasture. They are difficult to maintain, and erosion is a problem.

The potential is low for most urban use. The main limitations are the strong slope, the rocky areas, the shallowness of the Darnell soil, and the high shrink-swell potential of the Windthorst soil. Developing and maintaining most facilities is difficult. Capability subclass VIIs; Windthorst soil in Sandy Savannah range site, Darnell soil in Shallow Savannah range site.

55—Windthorst-Weatherford complex, 5 to 12 percent slopes. This unit is 35 percent the moderately well drained, moderately slowly permeable Windthorst soil and 30 percent the well drained, moderately permeable Weatherford soil. These sloping or strongly sloping soils occur on ridge crests and side slopes of uplands. The Windthorst soil is mostly on the upper part of the ridge crests or side slopes, and the Weatherford soil is on the mid and lower slopes.

In a representative profile of the Windthorst soil the surface layer is grayish brown, medium acid fine sandy loam 3 inches thick. The subsurface layer is 3 inches of pale brown, medium acid fine sandy loam. The upper 26 inches of the subsoil is yellowish red and reddish yellow, medium acid sandy clay. The lower 10 inches is reddish yellow, neutral sandy clay. The underlying layer is coarsely mottled, moderately alkaline soft shale.

This soil is 35 to 60 inches deep. The available water capacity to a depth of 40 inches is high. Natural fertility and organic matter content are generally low. The shrink-swell potential of the subsoil is medium to high.

In a representative profile of the Weatherford soil the surface layer is grayish brown, slightly acid fine sandy loam 5 inches thick. The subsurface layer is 9 inches of pale brown, slightly acid fine sandy loam. The upper 10 inches of the subsoil is yellowish red, slightly acid sandy clay loam. The next 16 inches is reddish yellow, medium acid sandy clay loam. The lower 15 inches is reddish yellow, distinctly mottled, slightly acid sandy clay loam. Below this is weakly consolidated sandstone.

Depth to rock ranges from 40 to 60 inches. The available water capacity is moderate. Natural fertility and organic matter content are generally low. The shrink-swell potential of the subsoil is low or moderate. The surface layer is medium acid to neutral.

About 15 percent of this map unit is included areas of Stephenville soils, 10 percent Darnell soil, and 10 percent Konsil soil. Rock crops out in a few areas.

This unit is used mainly for native grass or tame pasture. It also supports low quality hardwoods and an understory of native grass in most areas. The potential is medium for grasses.

The main concerns in management are the slope, the erosion hazard, brush control, soil structure, and fertility. A plant cover of native grass or tame pasture grass is the best way to reduce erosion. Areas can be cleared of brush and trees when erosion by runoff is least hazardous and revegetation can be accomplished quickly.

The potential is low to medium for most urban use. The chief limitations are slopes of 5 to 12 percent, the shallowness over bedrock of the Weatherford soil, and the moderate or high shrink-swell potential of the Windthorst soil. Capability subclass VIe; Sandy Savannah range site.

56—Woodford silt loam, 5 to 20 percent slopes. This very shallow to shallow, well drained, gently sloping to moderately steep soil is on ridgetops and hillsides.

Typically, the upper 7 inches of the surface layer is very dark gray, mildly alkaline silt loam that is about 20 percent coarse fragments of sandstone. The next 10 inches is dark gray, mildly alkaline silt loam that is about 65 percent coarse fragments of sandstone. The underlying material is brown fractured sandstone.

This soil is high in natural fertility and organic matter content. Permeability is moderate, and the available water capacity is low.

About 10 percent of this map unit is included areas of Scullin, Heiden, and Kiti soils. About 5 percent is areas of sandstone rock outcrop, and about 5 percent areas of soils that are similar to the Woodford soil but the surface layer and subsoil are slightly thicker and have a low percentage of fragments.

The potential is low for native grasses. The main concern in management is controlling grazing, protecting pasture from uncontrolled burning, and controlling brush or weeds. Slight soil losses from erosion are critical because of the shallowness of the soil.

The urban potential is low. The soils are shallow and gently sloping to moderately steep and have intermingled areas of rock outcrop. Capability subclass VIIs; Very Shallow range site.

57—Yahola soils. This map unit consists of well drained, nearly level to undulating soil on flood plains along the Washita River. It is frequently flooded.

Typically, the surface layer is 4 inches of reddish yellow, moderately alkaline fine sandy loam and 9 inches of light reddish brown, moderately alkaline loamy fine sand. The next layer to a depth of 38 inches is reddish yellow, moderately alkaline stratified fine sandy loam. The underlying material to a depth of 72 inches is stratified reddish yellow, moderately alkaline loamy fine sand.

This soil is low to moderate in natural fertility and organic matter content. Permeability is moderately rapid, and the available water capacity is medium. Tilth is fair and the root zone is deep.

About 20 to 25 percent of this map unit is included areas of a soil that has a coarse texture in the 10- to 40-inch section but is otherwise similar to the Yahola soils. Also included are a few intermingled areas of the Weswood soils.

This soil is generally too frequently flooded for most crops. The potential is high for pasture and hay.

The main concerns in management are flooding and erosion. Soil blowing and water erosion are problems unless the soil is protected by a permanent plant cover. Tame pasture grasses respond well to applications of fertilizer, which promote additional plant growth.

The potential is low for urban use. Frequent flooding and rapid percolation are limitations. Capability subclass Vw; Loamy Bottomland range site.

58—**Zaneis loam, 3 to 5 percent slopes.** This is a gently sloping, well drained soil that is moderately permeable. It occurs as narrow areas on upland ridge crests or hillsides.

In a representative profile the surface layer is brown, neutral loam 12 inches thick. The upper 15 inches of the subsoil is reddish brown, neutral clay loam. The next 12 inches is reddish brown, medium acid clay loam. The lower 9 inches is red, slightly acid clay loam. The underlying layer is red, slightly acid sandy shale.

This soil is high in natural fertility and organic matter content. The available water capacity is high. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and is easily penetrated by roots.

About 5 percent of this map unit is included areas of Chickasha loam, 5 percent areas of Renfrow soil, and 5 percent areas of a Zaneis soil that is deeper or shallower but is otherwise similar to this soil. A few areas of a Zaneis soil that has a fine sandy loam surface layer are also included.

This soil is used mostly for native pasture, tame pasture, small grain, and sorghum. The potential is medium for field crops but is high for grass.

The main concern in management is controlling erosion and maintaining soil structure and fertility. Fertilizing to obtain large amounts of crop residue improves and maintains soil structure and fertility. Terracing, contour farming, and close-growing crops are needed to control erosion. All crop residue should be returned to the soil, and tillage should be kept to a minimum. Row crops should be avoided to prevent excessive loss of soil by erosion. Native grasses or tame pasture is the best way to protect this soil from eroding.

The urban potential is high. The moderate shrink-swell potential in the lower part of the subsoil and the low strength are moderate limitations for some facilities. Capability subclass IIIe; Loamy Prairie range site.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, rangeland, and woodland; as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities; and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

By CLIFFORD E. RHOADS, district conservationist, and THEODORE B. LEHMAN, conservation agronomist, Soil Conservation Service.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the predicted yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

More than 133,000 acres in the survey area was used for crops and pasture in 1967, according to the Conservation Needs Inventory (*3*). Of this total, 74,000 acres was used for permanent pasture; 10,000 acres for row crops, mainly grain sorghum; 35,000 acres for close-grown crops, mainly wheat and oats; and 4,000 acres for rotation hay and pasture. The rest of the acreage was other cropland.

The potential of the soils in Carter County for increased production of food is good. About 51,000 acres of potential cropland is currently used as woodland. In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology.

The acreage in crops has gradually decreased as more and more land is used for pasture and for urban development. It was estimated that in 1967 about 29,000 acres in the county was urban and built-up land. This figure has been growing at a slow rate. The use of this soil survey in making land use decisions that can influence the future role of farming in the county is briefly discussed in the section "General soil map for broad land use planning."

Erosion is the major concern on about two-thirds of the cropland and pasture in Carter County. If slope is more than 1 percent, erosion is a hazard. Chickasha, Clarita, Konsil, Weatherford, and Windthorst soils, for example, are subject to erosion.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as the Durant, Renfrow, Wilson, and Windthorst soils, and on soils that have a layer in or below the subsoil that limits the depth of the root zone, for example, the bedrock underlying Kiti, Darnell, and Woodford soils. Erosion also reduces productivity on soils that tend to be droughty, such as Chigley and Eufaula soils. Second, soil erosion on farmland results in sediment entering streams. Control of erosion minimizes the pollution of streams by sediment and improves quality of water for municipal use, for recreation, and for fish and wildlife.

In many sloping fields, tilling or preparing a good seedbed is difficult on clayey or hardpan spots because the original friable surface soil has been eroded away. Such spots are common in areas of moderately eroded Normangee and Windthorst soils.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps a plant cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils. On livestock farms, which require pasture and hay, the legume and grass forage crops in the cropping system reduce erosion on sloping land and also provide nitrogen and improve tilth for the following crop.

Slopes are so short and irregular that contour tillage or terracing is not practical in some areas of the sloping Konsil soils. On these soils, cropping systems that provide a substantial plant cover are required to control erosion unless minimum tillage is practiced. Minimizing tillage and leaving crop residue on the surface increase infiltration and reduce the hazards of runoff and erosion. These practices can be adapted to most soils in the survey area, but are more difficult to use successfully on the eroded soils and on the soils that have a clayey surface layer, such as Heiden, Clarita, and Burleson soils. No tillage, which is effective in reducing erosion on sloping land, can be adapted to most soils in the survey area. It is difficult if the surface layer is clayey.

Terraces and diversions reduce the length of slope and reduce runoff and the risk of erosion. They are practical on deep, well drained soils that have regular slopes. Durant soils and Chickasha soils are suitable for terraces. Some other soils are less suitable for terraces and diversions because of irregular slopes, excessive wetness, a clayey subsoil which would be exposed in terrace channels, or bedrock at a depth of less than 40 inches.

Contouring and contour stripcropping are erosion control practices in the survey area. They can be best adapted to soils that have smooth, uniform slopes, including most areas of the sloping Chickasha, Clarita, Durant, Heiden, Konawa, Weatherford, Wilson, and Windthorst soils.

Soil blowing is a hazard on the sandy Konsil and Eufaula soils. Blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining a plant cover, a surface mulch, or a rough surface through proper tillage minimizes the risk. Windbreaks of suitable shrubs and trees also reduce the risk of soil blowing.

Information on the design of erosion control practices for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Soil drainage is the major management need on some of the acreage used for crops and pasture in the survey area. Some soils are so wet that crop production is reduced. The somewhat poorly drained Tullahasse and Wilson soils are examples.

Miller, Watonga, and Burleson soils have good natural drainage most of the year, but they tend to dry out slowly after rains. Small areas of wetter soils along drainageways and in swales are commonly included in areas of the moderately well drained Healdton, Miller, and Watonga soils. Artificial drainage is needed in some of the wetter areas.

The design of both surface and subsurface drainage systems depends on the kind of soil. Drains have to be more closely spaced in slowly permeable soils than in more permeable soils. Tile drainage is very slow in Wilson soils.

Information on drainage design for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Soil fertility is naturally medium in some soils of the uplands in the survey area. Other upland soils are high in natural fertility. The soils on flood plains, such as Bergstrom, Bunyan, Dale, Elandco, and Weswood soils, range from slightly acid to moderately alkaline and are naturally higher in plant nutrients than most upland soils.

Some soils on uplands are naturally acid. If they have never been limed, they require applications of ground limestone to raise the pH level sufficiently for good growth of crops. Available phosphorus and potash levels are naturally low in some of those soils. On all soils additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yield. The County Extension Service can help in determining the kinds and amounts of fertilizer and lime to be applied.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous.

Most of the soils used for crops in the survey area have a loamy surface layer. Generally the structure of such soils is weak, and intense rainfall causes the formation of a crust on the surface. The crust is hard when dry and nearly impervious to water. Once the crust forms, it reduces infiltration and increases runoff. Regular additions of crop residue, manure, and other organic material can improve soil structure and reduce crust formation.

The dark colored Burleson, Clarita, and Heiden soils are clayey. Tilth is a problem because they often stay wet until late in spring. If wet when plowed, they tend to be very cloddy when dry and a good seedbed is difficult to prepare. Fall plowing on such wet soils generally results in good tilth in the spring.

Field crops suited to the soils and climate of the survey area include many that are not now commonly grown. Grain sorghum, cotton, and soybeans are the row crops. Wheat and oats are the common close-growing crops.

Special crops grown commercially in the survey area are pecans, vegetables, small fruits, tree fruits, and nursery plants. A small acreage throughout the county is used for melons, strawberries, sweet corn, tomatoes, peppers, and other vegetables and small fruits. Apples and peaches are the most important tree fruits grown in the county. Pecans is an important crop on the flood plain soils in the county. Deep soils that have good natural drainage and that warm up early in spring are especially well suited to many vegetables and small fruits. Konawa, Konsil, and Duffau soils are examples.

Latest information and suggestions on growing special crops can be obtained from local offices of the County Extension Service and the Soil Conservation Service.

Tame pasture

General guidelines in managing soils for tame pasture plants are described in the paragraphs that follow. Those desiring more detailed information about management of soils can refer to "Soil maps for detailed planning."

The acreage of soils used for pasture and hay production in Carter County is increasing rapidly. Many idle fields of former cropland and poor-condition native range are being converted to tame pasture. Most soils in the county are suited to tame pasture.

The principal tame pasture grasses are improved bermudagrass, weeping lovegrass, and King Ranch bluestem.

Bermudagrass pasture is occasionally overseeded with rye, winter wheat, ryegrass, or fescue to provide late fall and early spring grazing. In some pastures the bermudagrass is overseeded with a cool season legume, such as hairy vetch.

Weeping lovegrass, an important grass in the county, is best suited to well drained sandy or loamy soils, such as Konawa, Konsil, or Weatherford. It supplies abundant summer forage but must be carefully managed in order to keep it palatable to livestock.

King Ranch bluestem, a common pasture grass in some parts of the county, is best suited to the more clayey soils, such as Burleson, Clarita, Heiden, and Tamford. It is difficult to establish, but it is drought resistant.

Sudangrass and hybrid forage sorghums are grown for hay and pasture in some parts of the county. These grasses are commonly planted on flood plain soils, such as Pulaski and Bunyan, for supplemental summer grazing.

Fescue is best suited to the flood plain soils that have large amounts of available moisture. On these soils, fescue produces about the same amount of forage as bermudagrass. Fescue furnishes some fall and winter grazing, but the best forage production is early in spring. Maintaining a vigorous stand of fescue on the upland soils is difficult.

Winter small grain combinations, such as rye and ryegrass and vetch and rye, are used on some cropland

soils to provide winter and spring forage. These crops are harvested for grain or hay. Usually they are grazed.

Planning a pasture program

A pasture program should be planned to provide the desired amount of forage during each month of the year. A study of the growth habits of the different plants is needed. The months that various kinds of forage plants grow are indicated in figure 9. The percentage of growth for each kind of plant is illustrated. For example, bermudagrass makes 22 percent of its yearly growth in June.

Soils vary in their capacity to produce forage for grazing. The Bunyan soil produces more forage than the Konsil soil, mainly because it furnishes more available moisture to the plant. Table 5 shows the total yearly production of each soil for various kinds of pasture plants in animal unit months (AUM). Bermudagrass pasture on Chickasha loam, 1 to 3 percent slopes, for example, furnishes grazing for one animal unit (AUM) 6.5 months during the year.

In planning a pasture program one must consider the total yearly production of the pasture plant in animal unit months, as listed in table 5, and the amount of growth during a given month, as shown in figure 9. Bermudagrass furnishes 22 percent of its annual forage during June. In June, therefore, according to the total yearly production shown in table 5, bermudagrass on the Chickasha soil provides grazing for 1.4 animal units. Accordingly, a pasture of 50 acres would furnish grazing for 70 animal units (50 acres times 1.4 AUM equals 70 AUM) during the month of June. Personnel in the Soil Conservation Service or County Extension Office can assist in planning a total pasture program for your farm.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil or that a given crop is not commonly irrigated.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 5.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The estimated yields reflect the productive capacity of the soils for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the County Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Rangeland

By ERNEST C. SNOOK, range conservationist, Soil Conservation Service.

This section contains information on the use of soils as rangeland. Rangeland is land on which the natural plant community is composed principally of grass, grasslike plants, and forbs and shrubs for grazing in sufficient quantity to justify grazing use. The range is usually grazed yearlong.

About 60 percent of Carter County is range. More than half of the farm income is derived from livestock, chiefly cattle. Cow-calf-steer operations are dominant. The size of ranches is from 40 acres up to about 10,000 acres.

On many ranches, the forage produced on rangeland is supplemented by tame pastures, crop stubble, and small grain. In winter the native forage is often supplemented with protein concentrate. Creep feeding of calves and yearlings to increase market weight is practiced on some ranches.

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 6 shows, for each kind of soil, the name of the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed cannot support a natural plant community of predominately grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 6.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Characteristic species of grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil are listed by common name. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Dominant in the northern part of the county are the loamy Kiti and Woodford soils, both of which are shallow over hard fractured rock. These soils support mostly mid and tall grasses. Potential productivity is low because of the shallow root zone.

In much of the southern part of the county the soils are sandy and are deep over soft sandstone. There are large areas of severely eroded Konsil soils. Potential productivity on these deep soils is much greater than on the shallower soils.

In the central part of the county, most of the soils are deep and have a loamy surface layer. If used as rangeland, they produce mostly tall grasses. Potential productivity is moderate to high.

The major management concern on most of the rangeland is control of grazing so that the kinds and amounts of plants that make up the potential plant community are re-established. Controlling brush and protecting the range from uncontrolled burning are also important management concerns. If sound range management based on the soil survey information and rangeland inventories is applied, the potential is good for increasing the productivity of range in the area.

Windbreaks and environmental plantings

By NORMAN E. SMOLA, woodland conservationist, Soil Conservation Service.

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broad-leaved and coniferous species provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field, the interval depending on erodibility of the soil. They protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. A healthy planting stock of suitable species planted properly on a well prepared site and maintained in good condition can insure a high degree of plant survival.

Table 7 shows the height that locally grown trees and shrubs are expected to reach on various kinds of soil in 20 years. The estimates in table 7, based on measurements and observation of established plantings that have been given adequate care, can be used as a guide in planning windbreaks and screens. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service, Oklahoma Forestry Division, or from nurserymen.

Engineering

By WILLIAM F. HARDESTY and JESSE L. MCMASTERS, civil engineers, Soil Conservation Service.

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined by using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to

the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 8 shows, for each kind of soil, the degree and kind of limitations for building site development; table 9, for sanitary facilities; and table 11, for water management. Table 10 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 8. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, and open ditches. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 8 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 8 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 9 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils were the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations of table 9 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 10 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in

table 14 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soil rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor.*

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 10 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 14.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 11 the degree of soil limitation and soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Soil and site limitations are expressed as slight, moderate, and severe. *Slight* means that the soil properties and site features are generally favorable for the specified use and that any limitation is minor and easily overcome. *Moderate* means that some soil properties or site features are unfavorable for the specified use but can be overcome or modified by special planning and design. *Severe* means that the soil properties and site features are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Aquifer-fed excavated ponds are bodies of water made by excavating a pit or dugout into a ground-water aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 11 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope, depth to bedrock, hardpan, or other unfavorable

material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

By NORMAN E. SMOLA, woodland conservationist, Soil Conservation Service.

The soils of the survey area are rated in table 12 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 12 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 9, and interpretations for dwellings without basements and for local roads and streets, given in table 8.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Wildlife habitat

By JEROME F. SYKORA, biologist, Soil Conservation Service.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 13, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that

restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, barley, sorghum, millet, cowpeas, soybeans, and sunflowers.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, alfalfa, bluegerass, switchgrass, sericea lespedeza, Korean lespedeza, and crownvetch.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, grama, indiangrass, pokeweed, native lespedeza, and partridgepea.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of native plants are oak, cottonwood, cherry, osageorange, hawthorn, dogwood, hickory, blackberry, blackhaw, persimmon, sumac, pecan, black walnut, and grape. Examples of fruit-producing shrubs that are commercially available and suitable for planning on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are redcedar and juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture. Examples of shrubs are roughleaf dogwood, coralberry, plum, and greenbrier.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, cattail, and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite quail, meadowlark, field sparrow, killdeer, cottontail, and fox.

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, woodcock, thrushes, vireos, woodpeckers, squirrels, fox, raccoon, and deer.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, rails, kingfishers, muskrat, mink, and beaver.

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include white-tailed deer, coyote, meadowlark, lark bunting, and bobwhite quail.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in

the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

Engineering properties

Table 14 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 14 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 14 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated classification, without group index numbers, is given in table 14. Also in table 14 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 15 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 16 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding; and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Engineering test data

The results of analyses of engineering properties of several typical soils of the survey area are given in table 17.

The data presented are for soil samples that were collected from carefully selected sites. The soil profiles sampled are typical of the series discussed in the section "Soil series and morphology." The soil samples were analyzed by the State of Oklahoma, Department of Highways, Materials Division.

The methods used in obtaining the data are listed by code in the next paragraph. Most of the codes, in parentheses, refer to the methods assigned by the American Association of State Highway and Transportation Officials. The codes for shrinkage and Unified classification are those assigned by the American Society for Testing and Materials.

The methods and codes are AASHTO classification (M-145-49); Unified classification (D-2487-69); mechanical analysis (T88-57); liquid limit (T89-60); plasticity index (T90-56); shrinkage (D-427).

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey (*5*) has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 18, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Entisol. Five of the ten orders are recognized in Carter County.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustolls (*Ust*, meaning dry plus *olls*, from Mollisols).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Argiustolls (*Argi*), meaning argillic horizons, plus *ust*, the suborder of Mollisols that has an ustic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Argiustolls.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, thermic Typic Argiustolls.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*4*). Unless otherwise noted, colors described are for dry soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or mapping units, of each soil series are described in the section "Soil maps for detailed planning."

Bergstrom series

The Bergstrom series consists of deep, well drained, moderately permeable, nearly level soils on flood plains. Slopes are 0 to 1 percent. The soils formed in loamy alluvium under a cover of trees and tall grasses.

Representative profile of Bergstrom silt loam, 65 feet east and 400 feet south of the northwest corner sec. 2, T. 1 S., R. 2 W.:

Ap—0 to 6 inches, grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak medium granular; very hard, friable; calcareous; moderately alkaline; clear smooth boundary.

A1—6 to 24 inches, dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak medium granular; very hard, friable; few fine masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B—24 to 55 inches, brown (7.5YR 4/2) silty clay loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; very hard, firm; common fine masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C—55 to 72 inches, reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; massive; very hard, firm; common threadlike masses of calcium carbonate; few black concretions; calcareous; moderately alkaline.

Thickness of the solum is 35 to 60 inches.

The Ap and A1 horizons are grayish brown, brown, or dark grayish brown. The Ap horizon is mildly alkaline through moderately alkaline. In some areas, it is noncalcareous. The A1 horizon is moderately alkaline and calcareous. It is silt loam or silty clay loam.

The B horizon is brown, dark brown, yellowish brown, strong brown, or reddish brown. It is a calcareous silt loam or silty clay loam.

The C horizon is the same color as the B horizon, including reddish yellow and light brown. In a few profiles there are a few brownish or reddish mottles. The texture is silt loam, silty clay loam, or clay loam.

Bergstrom soils occur as smooth, narrow to wide areas on flood plains. They are associated with Elandco soils and are similar to Dale and Elandco soils. The organic matter distribution in Dale soils decreases gradually with increasing depth. Those soils are rarely or never flooded. Elandco soils are not calcareous throughout.

Bunyan series

The Bunyan series are deep, well drained, moderately permeable, nearly level to very gently sloping soils on flood plains. Slopes are 0 to 2 percent. The soils formed in recent deposits of loamy alluvium under a cover of trees.

Representative profile of the Bunyan loam, 250 feet north and 2,430 feet west of the southeast corner sec. 26, T. 2 S., R. 3 W.:

A11—0 to 10 inches, dark yellowish brown (10YR 4/4) loam, dark yellowish brown (10YR 3/4) moist; weak fine granular structure; hard, friable; few thin strata of brown fine sandy loam; slightly acid; clear smooth boundary.

A12—10 to 24 inches, yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine granular structure; hard, very friable; few thin strata of brown loam; mildly alkaline; clear smooth boundary.

Ab—24 to 50 inches, grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; hard, friable; few black concretions; moderately alkaline; gradual smooth boundary.

C—50 to 72 inches, yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 3/4) moist; massive; hard, friable; few black concretions; mildly alkaline.

Thickness of the solum ranges from 35 to 60 inches.

The A11 and A12 horizons are dark yellowish brown, grayish brown, brown, yellowish brown, or pale brown. Stratification varies from scarcely evident to pronounced. The lower part of the A horizon is loam or fine sandy loam. The A horizon ranges from slightly acid to neutral in the upper part and from slightly acid to moderately alkaline in the lower part.

The Ab horizon is dark grayish brown, grayish brown, brown, or dark brown. It is loam or clay loam and is neutral to moderately alkaline.

The C horizon is similar in color to the A horizon. Some pedons have few to common brownish, reddish, or grayish mottles. Reaction is neutral to moderately alkaline. Texture is fine sandy loam, loam, or clay loam.

Bunyan soils occur as narrow to wide areas on flood plains. They are associated with Pulaski and Elandco soils and are similar to Yahola, Pulaski, and Weswood soils. Yahola and Pulaski soils have less than 18 percent clay in the control section. Weswood soils have more silt in the upper 40 inches of soil than Bunyan soils.

Burleson series

The Burleson series consists of deep, moderately well drained, very slowly permeable, nearly level soils on uplands. Slopes are 0 to 1 percent. The soils formed in thick clay deposits in broad smooth uplands.

Representative profile of Burleson clay, 0 to 1 percent slopes, 2,400 feet north and 550 feet east of the southwest corner sec. 33, T. 2 S., R. 1 E.:

Ap—0 to 5 inches, dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak medium blocky structure breaking to weak medium granular; very hard, very firm; few chert fragments 2 mm to 10 mm in diameter; moderately alkaline; clear wavy boundary.

A11—5 to 20 inches, very dark gray (N 3/0) clay, black (N 2/0) moist; weak medium blocky structure; extremely hard, extremely firm; few distinct slickensides; moderately alkaline; gradual wavy boundary.

A12—20 to 40 inches, dark gray (N 4/0) clay, very dark gray (N 3/0) moist; weak coarse blocky structure; extremely hard, extremely firm; few distinct slickensides that intersect; few chert fragments 2 mm to 10 mm in diameter; moderately alkaline; gradual wavy boundary.

AC—40 to 53 inches, gray (10YR 5/1) silty clay, dark gray (10YR 4/1) moist; weak coarse blocky structure; extremely hard, extremely firm; distinct slickensides that intersect; few cracks and few ped faces with dark gray (N 4/0) coatings; few bodies of grayish brown (2.5Y 5/2) in the mass; few fine soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—53 to 80 inches, grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, extremely firm; few slickensides with dark gray (10YR 4/1) coatings; common fine soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

Thickness of the combined A and AC horizons ranges from 40 to 72 inches. In virgin areas gilgai microrelief consists of knolls 3 to 8 inches higher than depressions. The distance between the center of the knolls and the center of the depressions ranges from about 8 to 12 feet. Intersecting slickensides are at depths of 20 to 30 inches. Thickness of the A horizon ranges from 12 inches in the microknolls to 50 inches in the microdepressions.

The A horizon is dark gray or very dark gray. Reaction is slightly acid to moderately alkaline.

The AC horizon is gray, dark gray, grayish brown, or dark grayish brown. Some pedons have few to common gray, brown, or olive mottles. Most pedons have cracks lined or filled with darker material like the A1 horizon. Reaction is mildly alkaline to moderately alkaline.

The C horizon is grayish brown, dark gray, gray, or brown. Some pedons have mottles of olive, brown, or yellowish brown. Reaction is moderately alkaline. The soil is noncalcareous to calcareous and has soft powdery carbonates.

Burleson soils are similar to Watonga and Heiden soils. Watonga soils have brownish colors within the upper 40 inches of the solum and formed in flood plains. Heiden soils have more brownish colors in the A horizon. The associated soils are Heiden and Wilson soils.

Chickasha series

The Chickasha series are deep, well drained, moderately permeable, very gently sloping to gently sloping soils on uplands. Slopes range from 1 to 5 percent. The soils formed in material weathered from sandstone under a cover of prairie grasses. They are on broad to narrow ridge crests and smooth side slopes.

Representative profile of Chickasha loam, 1 to 3 percent slopes, 1,880 feet east and 1,980 feet north of the southeast corner sec. 6, T. 4 S., R. 3 W.:

A1—0 to 12 inches, grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; medium acid; gradual smooth boundary.

B21t—12 to 24 inches, reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; weak medium prismatic structure and weak medium subangular blocky; hard, friable; thin clay films on faces of peds; medium acid; gradual smooth boundary.

B22t—24 to 44 inches, reddish yellow (7.5YR 6/8) sandy clay loam, strong brown (7.5YR 5/8) moist; weak medium prismatic structure and weak medium subangular blocky; hard, firm; thin clay films on faces of peds; medium acid; gradual smooth boundary.

B3—44 to 58 inches, reddish yellow (7.5YR 7/8) sandy clay loam, reddish yellow (7.5YR 6/8) moist; weak medium subangular blocky structure; hard, friable; few thin sandstone fragments in the lower part; medium acid; abrupt wavy boundary.

C—58 to 65 inches, light gray (10YR 7/2) sandstone, common medium distinct mottles of reddish yellow (7.5YR 6/8); hard when dry, soft to hard when moist.

Thickness of the soil ranges from 40 to 60 inches and corresponds with the depth to bedrock.

The A horizon is grayish brown, brown, dark brown, or dark grayish brown.

In some profiles a B1 horizon occurs. It has colors and textures similar to those of the B21t horizon. It is neutral to medium acid.

The B21t horizon is brown, dark brown, strong brown, reddish yellow, dark yellowish brown, yellowish brown, or brownish yellow. In some profiles reddish or brownish mottles occur. The texture is loam or sandy clay loam. Reaction ranges from medium acid to neutral.

The B22t horizon is the same color as the B21t horizon, including strong brown, reddish yellow, yellowish brown, or brownish yellow. It is loam, clay loam, or sandy clay loam and ranges from medium acid to moderately alkaline.

The C horizon is grayish, brownish, or yellowish soft sandstone.

Chickasha soils are similar to Zaneis soils. Zaneis soils have redder hues in the B horizon than Chickasha soils. The associated soils are Zaneis and Renfrow soils.

Chigley series

The Chigley series consists of deep, moderately well drained, moderately slowly permeable soils of the uplands. These soils are on narrow strongly sloping to steep side slopes. Slopes range from 10 to 30 percent. The Chigley soils formed in cherty conglomerate interbedded with sandstone and shale under a cover of trees. A perched water table occurs at a depth of 3 to 4 feet in part of the year.

Typical pedon of Chigley gravelly loam in an area of Chigley-Darnell Variant complex, 10 to 30 percent slopes, 300 feet east and 500 feet north of the southwest corner sec. 29, T. 2 S., R. 1 E.:

A1—0 to 2 inches, pale brown (10YR 6/3) gravelly loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; 15 percent by volume flattened and rounded sandstone and chert fragments 2 millimeters to 3 inches in the long axis; some mixing of very pale brown (10YR 8/4) A2 horizon colors; slightly acid; clear wavy boundary.

A2—2 to 6 inches, very pale brown (10YR 8/4) gravelly loam, light yellowish brown (10YR 6/4) moist; weak fine granular structure; slightly hard, very friable; 35 percent by volume flattened and rounded sandstone and chert fragments 2 millimeters to 3 inches in the long axis; some mixing of pale brown (10YR 6/3) A1 horizon colors; very strongly acid; clear wavy boundary.

B21t—6 to 16 inches, reddish yellow (5YR 6/6) clay, yellowish red (5YR 4/6) moist; weak medium blocky structure; very hard, very firm; distinct clay films; many peds with very pale brown (10YR 8/4) coatings; 15 percent by volume flattened and rounded sandstone and chert fragments 2 millimeters to 3 inches in the long axis; strongly acid; gradual wavy boundary.

B22t—16 to 42 inches, reddish yellow (5YR 6/6) clay, yellowish red (5YR 4/6) moist; weak medium and coarse blocky structure; very hard, very firm; distinct clay films; few peds with very pale brown (10YR 7/3) coatings; 10 percent by volume flattened and rounded sandstone and chert fragments 2 millimeters to 3 inches in the long axis; few fine and medium black concretions; medium acid; clear wavy boundary.

C—42 to 44 inches, fractured hard sandstone interbedded with hard shale and cherty conglomerate.

Solum thickness ranges from 40 to 60 inches but is commonly less than 50 inches.

The A1 horizon is pale brown, light brownish gray, grayish brown, or brown.

The A2 horizon is very pale brown, light brownish gray, light brown, or pale brown. The A1 horizon is neutral to medium acid, and the A2 horizon is medium acid through very strongly acid.

The B2t horizon is reddish yellow, yellowish red, or strong brown. The texture is clay or heavy clay loam. Reaction is medium acid or strongly acid. Gravel fragments range from 10 to 25 percent.

Some pedons have a B3 horizon with colors similar to those in the B2t horizon, including few to many brownish, grayish, or reddish mottles. Fragments of chert and sandstone range from 10 to 35 percent by volume.

The C horizon is hard fractured sandstone interbedded with layers of cherty conglomerate and shale. It is commonly tilted 20 to 50 degrees from horizontal.

Chigley soils are similar to Windthorst soils. Windthorst soils lack gravelly fragments and formed in clay or soft shale. Chigley soils are mapped only with the Darnell Variant.

Clarita series

The Clarita series consists of deep, moderately well drained, very slowly permeable soils that formed in material weathered from calcareous clays and clay shales on uplands. These soils are on gently sloping hillsides. Slopes range from 3 to 5 percent.

Typical pedon of Clarita silty clay, 3 to 5 percent slopes, 1,000 feet east and 1,040 feet south of the northwest corner sec. 13, T. 1 S., R. 2 W.:

A11—0 to 13 inches, very dark grayish brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; strong medium granular structure; very hard, very firm; few slickensides; few fine chert and limestone gravel; calcareous; moderately alkaline; gradual wavy boundary.

A12—13 to 24 inches, dark brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; moderate fine and medium blocky structure; very hard, very firm; intersecting slickensides; few fine and medium chert and limestone gravel; calcareous; moderately alkaline; gradual wavy boundary.

AC—24 to 45 inches, reddish brown (5YR 5/4) silty clay, reddish brown (5YR 4/4) moist, weak medium blocky structure; extremely hard, very firm; few bodies and coatings on ped faces with dark brown (7.5YR 4/2) intersecting slickensides; few powdery masses and concretions of calcium carbonate; few fine and medium chert and limestone gravel; calcareous; moderately alkaline; gradual wavy boundary.

C—45 to 80 inches, reddish brown (5YR 5/4) silty clay, reddish brown (5YR 4/4) moist; massive; extremely hard, extremely firm; few medium and coarse bodies of reddish yellow (5YR 6/6) and red (2.5YR 4/6); few slickensides; common powdery masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The A and AC horizons combined are 35 to 65 inches thick. They are thinnest in the microhigh and thickest in the microlow. The texture throughout is silty clay, clay, or heavy silty clay loam.

The A horizon is dark grayish brown, very dark grayish brown, or dark brown. Some pedons are calcareous to noncalcareous in the A horizon. All horizons are moderately alkaline.

The AC horizon is reddish brown, yellowish red, reddish yellow, brown, or strong brown.

The C horizon is similar in color to the AC horizon, and some pedons have red to gray mottles.

This Clarita soil is a taxadjunct to the Clarita series because it has a brownish A horizon in more than 50 percent of the pedons. It is similar enough to Clarita soils in behavior that nothing would be gained by adding another series name.

Clarita soils are similar to Grainola and Tamford soils. Tamford and Grainola soils have colors with higher chromas than Clarita throughout the upper 12 inches. In addition, Grainola soils have a thinner solum than Clarita soils. Clarita soils are usually associated with Heiden soils.

Dale series

The Dale series are deep, well drained, moderately permeable, nearly level soils on broad smooth stream terraces. Slopes are 0 to 1 percent. The soils formed in loamy alluvial sediments under a cover of prairie grasses and scattered trees.

Representative profile of Dale silt loam, 2,540 feet north and 950 feet east of the southwest corner sec. 22, T. 3 S., R. 3 E.:

Ap—0 to 6 inches, brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak fine granular structure; hard, very friable; slightly acid; clear smooth boundary.

A1—6 to 15 inches, brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak medium granular structure; hard, friable; slightly acid; gradual smooth boundary.

B21—15 to 34 inches, reddish brown (5YR 4/3) silt loam, dark reddish brown (5YR 3/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; very hard, firm; neutral; gradual smooth boundary.

B22—34 to 54 inches, reddish brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, friable; neutral; gradual smooth boundary.

C—54 to 72 inches, yellowish red (5YR 5/6) silty clay loam, yellowish red (5YR 4/6) moist; few strata of red (2.5YR 4/6); massive; very hard, firm; common powdery masses of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 40 to 65 inches.

The A horizon is dark grayish brown, brown, dark brown, grayish brown, or reddish brown. It is medium or slightly acid.

The B21 horizon is reddish brown. It is silt loam or silty clay loam and slightly acid through mildly alkaline.

The B22 horizon is reddish brown, yellowish red, or reddish yellow. It is silt loam or silty clay loam and neutral through moderately alkaline.

The C horizon is reddish brown, yellowish red, red, or reddish yellow. It is silt loam or silty clay loam.

Dale soils occur as broad smooth areas on terraces. They are commonly associated with Konawa soils. They are similar to Elandco and Bergstrom soils. Elandco and Bergstrom soils have irregular organic matter distribution and have a higher flood hazard than Dale soils.

Darnell series

The Darnell series consists of shallow, well drained to somewhat excessively drained, moderately rapidly permeable soils. These soils formed in material weathered from sandstone. They are on ridgetops and on side slopes. Slopes range from 2 to 20 percent.

Typical pedon of Darnell fine sandy loam in an area of Windthorst-Darnell complex, 5 to 20 percent slopes, 1,200 feet west and 2,600 feet north of the southeast corner sec. 29, T. 5 S., R. 2 E.:

A1—0 to 2 inches, grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable; some mixing of pale brown (10YR 6/3) colors; neutral; clear smooth boundary.

A2—2 to 6 inches, pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; some mixing of very pale brown (10YR 7/4) colors; 5 percent by volume soft yellow (10YR 7/6) sandstone fragments that are less than 3 inches in diameter; slightly acid; gradual wavy boundary.

B—6 to 16 inches, very pale brown (10YR 7/4) fine sandy loam, yellowish brown (10YR 5/4) moist; weak fine granular structure; slightly hard, very friable; 10 percent by volume soft sandstone fragments 1 to 3 inches in diameter, 5 percent by volume soft sandstone fragments 3 to 6 inches in diameter; slightly acid; clear wavy boundary.

C—16 to 28 inches, reddish yellow (7.5YR 6/6) weakly cemented sandstone, strong brown (7.5YR 5/6) moist; medium acid.

Depth to bedrock is 10 to 20 inches.

The A1 horizon is grayish brown, brown, or pale brown. It is neutral to strongly acid.

The A2 horizon, where present, is slightly lighter in color than the A1 horizon. Reaction is neutral through strongly acid.

The B horizon is very pale brown, pale brown, light yellowish brown, yellow, reddish yellow, or reddish brown. It is fine sandy loam or loam and neutral through medium acid. Soft fragments more than 3 inches in diameter commonly range from 0 to 15 percent by volume.

The C horizon is weakly to strongly cemented sandstone. It is reddish brown, yellowish red, reddish yellow, strong brown, or brown. It is neutral through strongly acid.

Darnell soils are mapped only with Windthorst and Stephenville soils. They are similar to Stephenville soils, which have a thicker solum and a more clayey texture in the B horizon.

Darnell Variant

The Darnell Variant consists of shallow, well drained, moderately rapidly permeable soils formed in material weathered from fractured hard sandstone and interbedded hard shales. These soils are on hillsides. Slopes range from 10 to 30 percent.

Typical pedon of the Darnell Variant in an area of Chigley-Darnell Variant complex, 10 to 30 percent slopes, 300 feet north and 190 feet west of the southeast corner sec. 30, T. 2 S., R. 1 E.:

A1—0 to 5 inches, pale brown (10YR 6/3) channery loam, brown (10YR 4/3) moist; weak fine granular structure; hard, very friable; 25 percent by volume flattened sandstone and chert fragments 1/4 inch to 3 inches in diameter on the long axis; slightly acid; clear wavy boundary.

B2—5 to 17 inches, very pale brown (10YR 8/4) very channery clay loam, yellowish brown (10YR 5/4) moist; weak fine granular struc-

ture; hard, friable; 80 percent by volume flattened sandstone and shale fragments 1 inch to 6 inches in diameter on the long axis; few fine black concretions; very strongly acid; clear wavy boundary.

C—17 to 20 inches, hard sandstone interbedded with hard shales.

Solum thickness is 8 to 20 inches.

The A1 horizon is pale brown, light brownish gray, grayish brown, or brown. It is medium acid through slightly acid. Fragments range from 15 to 45 percent by volume.

The B2 horizon is very pale brown, pale brown, light yellowish brown, light brown, or light brownish gray. It is a loam, silt loam, or silty clay loam that is 50 to 90 percent fragments. It is medium acid through very strongly acid.

The C horizon is fractured sandstone bedrock that is interbedded with layers of hard shale or chert. It is commonly tilted 20 to 50 degrees from horizontal.

The Darnell Variant soil is a variant to the Darnell series because it has more than 35 percent fragments in the control section.

The Darnell Variant is associated with Chigley soils, which have a more clayey subsoil and a thicker solum.

Duffau series

The Duffau series consists of deep, well drained, moderately permeable, gently sloping and sloping soils on uplands. Slopes range from 3 to 8 percent. The soils formed in weakly consolidated sandstone under a cover of trees and tall grasses.

Representative profile of Duffau fine sandy loam in an area of Weatherford-Duffau complex, 3 to 8 percent slopes, 680 feet west and 10 feet north of the southeast corner sec. 35, T. 1 S., R. 3 W.:

A1—0 to 9 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.

A2—9 to 15 inches, pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.

B21t—15 to 32 inches, yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist, weak coarse prismatic structure; hard, firm; clay films on faces of peds; mildly alkaline; gradual smooth boundary.

B22t—32 to 44 inches, yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; few medium faint mottles of reddish brown (5YR 4/4); weak coarse prismatic structure; very hard, firm; thin clay films on faces of peds; neutral; gradual smooth boundary.

B3—44 to 66 inches, reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; common medium distinct mottles of pink (5YR 7/3) and red (2.5YR 4/6); weak coarse prismatic structure; very hard, firm; slightly acid; gradual wavy boundary.

C—66 to 80 inches, reddish yellow (5YR 7/6) and red (2.5YR 4/6) weakly cemented sandstone; massive; very hard, firm; 5 percent angular and rounded chert gravel; slightly acid.

Depth to sandstone ranges from 60 to about 90 inches.

The A1 horizon is pale brown, brown, grayish brown, or light brownish gray. It is slightly acid to mildly alkaline.

The A2 horizon is slightly lighter in color than the A1 horizon. The A2 horizon is slightly acid through mildly alkaline.

The B2t and B3 horizons are reddish brown, yellowish red, reddish yellow, red, or strong brown. In most pedons the lower part of the B2t and the B3 horizons contain few to common pinkish, reddish, or brownish mottles. They range from slightly acid through mildly alkaline.

The C horizon is mainly weakly consolidated sandstone but in some areas is massive sandy loam.

Duffau soils are similar to Konawa and Konsil soils. Konawa and Konsil soils have less than 75 percent base saturation in the Bt horizon. Duffau soils are mapped only with Weatherford soils.

Durant series

The Durant series consists of deep, moderately well drained, very slowly permeable soils. The soils formed in material weathered from mostly clays or shales on uplands. Slopes range from 1 to 5 percent. Durant soils are very gently sloping to gently sloping and occur on prairies. They are on broad smooth ridgetops, on hillsides, and in valleys.

Typical pedon of Durant loam, 3 to 5 percent slopes, 600 feet east and 120 feet south of the northwest corner sec. 34, T. 4 S., R. 1 E.:

A1—0 to 10 inches, dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; hard, friable; medium acid; clear smooth boundary.

B1—10 to 15 inches, dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium blocky structure; very hard, firm; medium acid; clear smooth boundary.

B21t—15 to 26 inches, brown (10YR 5/3) clay, brown (10YR 4/3) moist; common fine distinct mottles of reddish brown; moderate medium blocky structure; extremely hard, very firm; common bodies and coatings on peds of dark grayish brown; few slickensides; distinct clay films on faces of peds; few fine black concretions and cherty fragments; slightly acid; gradual wavy boundary.

B22t—26 to 55 inches, grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; few medium faint mottles of light yellowish brown (2.5Y 6/4); weak medium blocky structure; extremely hard, very firm; few slickensides; distinct clay films on faces of peds; few fine black concretions; few powdery masses and few fine concretions of calcium carbonate; moderately alkaline; gradual smooth boundary.

B3—55 to 72 inches, light olive brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; common medium distinct mottles of light brownish gray (10YR 6/2); weak coarse blocky structure; extremely hard, very firm; few fine brown and black concretions; few masses of powdery calcium carbonate; moderately alkaline.

The solum is more than 40 inches thick. Depth to secondary carbonates ranges from 30 to 50 inches.

The A1 horizon is dark gray, dark brown or brown, dark grayish brown, or grayish brown. Texture is dominantly loam but is silt loam in places. Reaction is medium through slightly acid. The A to B boundary is clear or gradual.

The B1 horizon is brown, dark brown, dark grayish brown, grayish brown, or dark yellowish brown. Texture is clay loam or clay. Reaction is medium acid through neutral.

The B2t horizon has similar colors to the B1 horizon but includes yellowish brown, light yellowish brown, or brownish yellow. Mottles are few to common reddish or brownish. Reaction is slightly acid through moderately alkaline.

The B3 horizon has colors like the B2t horizon but includes mottles of grayish brown to light brownish gray. Texture is clay or heavy clay loam. Reaction is mildly or moderately alkaline.

The C horizon in a few pedons is strong brown, reddish yellow, yellowish brown, light yellowish brown, or brownish yellow. There are few to common reddish, brownish, or grayish mottles. Texture is clay or shale. Reaction is moderately alkaline.

Durant soils are commonly associated with Steedman and Normangee soils and are similar to Renfrow, Steedman, and Normangee soils. Renfrow soils have a redder hue in the subsoil and formed in claybeds of Permian age.

Steedman and Normangee soils have less than 10 inches of a dark colored surface layer.

Elandco series

The Elandco series consists of deep, moderately permeable, well drained alluvial soils. These nearly level soils occur on broad smooth flood plains. They formed in loamy alluvium under a cover of scattered trees and tall grasses. Slopes are 0 to 1 percent.

Typical pedon of Elandco clay loam, 750 feet north and 75 feet west of the southeast corner sec. 8, T. 3 S., R. 1 W.:

Ap—0 to 7 inches, grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; hard, friable; mildly alkaline; clear smooth boundary.

A11—7 to 16 inches, dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky structure; very hard, firm; neutral; gradual smooth boundary.

A12—16 to 32 inches, dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; very hard, very firm; slightly acid; gradual smooth boundary.

B—32 to 48 inches, dark yellowish brown (10YR 4/4) silty clay loam, dark yellowish brown (10YR 3/2) moist; weak medium subangular blocky structure; very hard, very firm; neutral; gradual smooth boundary.

C—48 to 65 inches, brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; massive; hard, firm; few threads and masses of calcium carbonate; moderately alkaline.

The solum thickness ranges from 36 to 72 inches.

The A horizon is dark gray, grayish brown, dark grayish brown, or dark brown. Texture below the Ap horizon is silty clay loam or clay loam. The A horizon ranges from slightly acid to mildly alkaline.

The B and C horizons are grayish brown, brown, dark grayish brown, or dark yellowish brown. They are neutral to mildly alkaline.

Elandco soils are associated with Bergstrom, Pulaski, and Bunyan soils and are similar to Dale and Bergstrom soils. The organic matter content in Dale soils decreases with increasing depth. Bergstrom soils are calcareous in the upper part.

Eufaula series

The Eufaula series consists of deep, somewhat excessively drained, rapidly permeable, gently sloping to moderately steep soils on uplands. Slopes range from 5 to 15 percent. The soils formed in material weathered from mostly sandy sediments under a cover of trees and tall grasses.

Representative profile of Eufaula fine sand, 5 to 15 percent slopes, 1,940 feet south and 400 feet west of the northeast corner sec. 35, T. 5 S., R. 2 W.:

A1—0 to 4 inches, dark grayish brown (10YR 4/2) fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; slightly acid; clear smooth boundary.

A2—4 to 55 inches, pink (7.5YR 7/4) fine sand, light brown (7.5YR 6/4) moist; single grained; loose dry or moist; medium acid; diffuse smooth boundary.

A&B—55 to 80 inches, pink (7.5YR 7/4) fine sand, light brown (7.5YR 6/4) moist (A); single grained; soft, loose; contains massive lamellae of reddish yellow (7.5YR 7/6) loamy fine sand (B); slightly hard, very friable; lamellae are 1/8 inch to 2 inches thick and 2 to 6 inches apart and have clay bridges between the sand grains; strongly acid.

Thickness of the solum exceeds 72 inches.

The A1 horizon is dark brown, dark grayish brown, grayish brown, light brownish gray, or light yellowish brown. It is medium acid through neutral.

The A2 horizon is pinkish gray, light brownish gray, very pale brown, pale brown, pink, or light brown. It is loamy fine sand or fine sand and medium acid through neutral.

The A&B horizon is similar in color and texture to the A2 horizon. It is strongly acid through neutral.

The B horizon is yellowish red, reddish yellow, or light reddish brown. It is fine sandy loam or loamy fine sand that occurs as lamellae 1/8 inch to 2 inches thick within the A&B horizon.

Eufaula soils occur on gently sloping to moderately steep ridge crests. In most places they are undulating or rolling. They are associated with Konsil soils. Konsil soils have thinner surface and subsurface layers and are continuous sandy clay loam in the upper subsoil.

Grainola series

The Grainola series consists of moderately deep, well drained, slowly permeable soils formed in material weathered from calcareous reddish shales and clays. These sloping to moderately steep soils occur on rolling ridgetops and hillsides. Slopes range from 5 to 20 percent.

Typical pedon of Grainola clay loam in an area of Tamford-Grainola complex, 5 to 12 percent slopes, 500 feet north and 60 feet west of the southeast corner sec. 33, T. 4 S., R. 3 W.:

A1—0 to 3 inches, reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; moderate medium granular structure; very hard, firm; calcareous; moderately alkaline; gradual wavy boundary.

B21—3 to 20 inches, reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; weak medium blocky structure; extremely hard, extremely firm; distinct slickensides; few strongly and weakly cemented calcium carbonate concretions; calcareous; moderately alkaline; gradual wavy boundary.

B22—20 to 32 inches, weak red (10R 4/4) clay, dusky red (10R 3/4) moist; weak coarse blocky structure; extremely hard, extremely firm; distinct slickensides; few fine strongly and weakly cemented calcium carbonate concretions; calcareous; moderately alkaline; gradual wavy boundary.

C—32 to 72 inches, red (10R 4/6) clay, dark red (10R 3/6) moist; massive; extremely hard, extremely firm; few seams of red (10R 4/6) shaly clay; few weakly and strongly cemented calcium carbonate concretions; calcareous; moderately alkaline.

The combined thickness of the A1 and B2 horizons ranges from 20 to 40 inches. Texture throughout the soil is clay loam, gravelly clay loam, clay, or gravelly clay.

The A1 horizon is reddish brown, reddish gray, or dark reddish gray. It is slightly acid through moderately alkaline and calcareous or noncalcareous.

The B2 horizon is reddish brown, yellowish red, weak red, or red. Some pedons lack a B22 horizon.

The A1 and B2 horizons contain weakly to strongly cemented calcium carbonate concretions that range from few to 15 percent by volume.

The C horizon is calcareous, weathered shale or clay. It is yellowish red, reddish brown, weak red, or red with or without mottles of white, gray, or brown.

Grainola soils are mapped only with Tamford and Kiti soils. Grainola soils are similar to Clarita, Tamford, Steedman, and Normangee soils. Tamford and Normangee soils have a thicker solum. Steedman and Normangee soils lack reddish hues in the dominant part of the subsoil and underlying layers.

Healdton series

The Healdton series consists of deep, moderately well drained, very slowly permeable soils on flood plains. These soils occur on broad, smooth areas under a cover of salt tolerant grasses and scattered trees. Slopes are 0 to 1 percent. The soils formed in material weathered from silty to clayey alluvium. A perched water table occurs at a depth of 6 to 18 inches most of the year.

Typical pedon of Healdton silt loam, 350 feet north and 25 feet east of the southwest corner sec. 35, T. 3 S., R. 2 E.:

Ap—0 to 6 inches, light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate medium platy structure parting to weak medium granular; hard, friable; dark grayish brown (10YR 4/2) coatings on faces of peds; slightly acid; abrupt smooth boundary.

B21t—6 to 10 inches, dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate coarse columnar structure parting to moderate medium blocky; extremely hard, very firm; light brownish gray (10YR 6/2) silt coatings on faces of peds and columns; clay films on faces of peds; mildly alkaline; gradual wavy boundary.

B22t—10 to 26 inches, dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; extremely hard, extremely firm; grayish brown (10YR 5/2) silt coatings on faces of peds; few slickensides; clay films on faces of peds; moderately alkaline; gradual smooth boundary.

B3—26 to 45 inches, brown (10YR 4/3) silty clay, dark brown (10YR 3/3) moist; weak coarse blocky structure; extremely hard, extremely firm; dark gray (10YR 4/1) silt coatings on faces of peds; common films and soft masses of salts; few fine calcium carbonate concretions; moderately alkaline; gradual smooth boundary.

C—45 to 80 inches, brown (10YR 5/3) silty clay, brown (10YR 4/3) moist; massive; extremely hard, extremely firm; few fine soft masses and concretions of calcium carbonate; moderately alkaline.

Solum thickness ranges from 40 to more than 60 inches. Depth to secondary carbonates ranges from 40 to 65 inches. Exchangeable sodium in the B2t horizon ranges from 15 to 25 percent.

The A horizon is light brownish gray, light gray, or pale brown. It is silt loam, loam, or silty clay loam and is slightly acid or neutral. The boundary of the A to Bt horizon is abrupt or clear.

The B2t horizon is dark gray, gray, grayish brown, brown, or dark grayish brown. In some pedons it has brown or pale brown mottles in the upper part and grayish mottles in the lower part. The B2t horizon is silty clay, clay, or silty clay loam, and it ranges from neutral to moderately alkaline.

The B3 and C horizons are brown, dark grayish brown, dark gray, yellowish brown, or strong brown. Some pedons have brownish or grayish mottles. The texture is silty clay, clay, clay loam, or silty clay loam. Reaction is mildly alkaline or moderately alkaline.

Healdton soils are associated with Watonga soils, which are clayey throughout. Wilson soils are similar to Healdton soils, but they are on uplands and have lower concentrations of sodium in the subsoil.

Heiden series

The Heiden series consists of deep, well drained, very slowly permeable soils formed in material weathered from clays or shaly clays. These soils are very gently sloping on ridgetops and swales and sloping to strongly sloping on hillsides. Slopes range from 1 to 12 percent.

Typical pedon of Heiden clay, 1 to 3 percent slopes, 1,900 feet south and 80 feet east of the northwest corner sec. 31, T. 2 S., R. 1 E.:

A1—0 to 9 inches, dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium granular structure; very hard, very firm; few cherty fragments; mildly alkaline; clear wavy boundary.

AC1—9 to 30 inches, dark grayish brown (2.5Y 4/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; weak coarse blocky structure; extremely hard, extremely firm; distinct intersecting slickensides; common cracks lined with dark gray (10YR 4/1); common concretions of calcium carbonate; few cherty fragments; moderately alkaline; gradual wavy boundary.

AC2—30 to 44 inches, grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak coarse blocky structure; extremely hard, extremely firm; distinct intersecting slickensides; common cracks and bodies with dark gray (10YR 4/1) colors; few soft masses and common concretions of calcium carbonate; few black concretions and cherty fragments; calcareous; moderately alkaline; gradual wavy boundary.

C—44 to 72 inches, light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; common medium distinct mottles of olive yellow (2.5Y 6/6); massive; extremely hard, extremely firm; common 1 inch to 6 inch strata of gray to olive yellow shales; common soft masses of calcium carbonate; calcareous; moderately alkaline.

The combined thickness of the A and AC horizons is about 40 to 60 inches. These horizons are the thinnest in the microhighs and thickest in the microlows. Cracks extend from the surface to a depth of several feet when the soil is dry.

The A1 horizon is dark gray, dark grayish brown, very dark grayish brown, or very dark gray. When colors are dark gray or very dark gray, it is less than 12 inches thick. It ranges from neutral through moderately alkaline and is calcareous in some pedons.

The AC horizon is dark grayish brown, grayish brown, brown, light olive brown, or yellowish brown. Some pedons have brownish to grayish mottles. Most pedons are calcareous in some part. Texture is clay or silty clay.

The C horizon is light brownish gray, dark grayish brown, light olive brown, yellowish brown, or olive brown. Most pedons have yellowish to grayish mottles. The texture is clay, silty clay, or shaly clay.

Heiden soils are similar to Burleson, Tamford, and Watonga soils. Burleson and Watonga soils have a thicker grayish surface layer. Watonga soils are on flood plains. Tamford soils have redder hues throughout. Burleson, Clarita, and Wilson soils are generally associated with Heiden soils.

Kemp series

The Kemp series consists of deep, moderately well drained, moderately permeable, nearly level to very gently sloping soils. These soils are on flood plains that are subject to flooding. They formed in mostly loamy alluvium under a cover of trees with an understory of native grasses. Slopes are 0 to 2 percent. The water table occurs at a depth of 2 to 3 feet for most of the year.

Representative profile of Kemp loam in an area of Kemp and Tullahassee soils, 1,050 feet west and 150 feet south of the northeast corner sec. 21, T. 5 S., R. 3 E.:

A11—0 to 6 inches, pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak fine granular structure; hard, very friable; few faint strata of light brownish gray (10YR 6/2); slightly acid; clear smooth boundary.

A12—6 to 20 inches, pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak coarse subangular blocky structure; very hard, very friable; few peds with white (10YR 8/2) coatings; slightly acid; clear smooth boundary.

Ab—20 to 48 inches, grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; few fine faint brown and few fine distinct

gray and brownish yellow mottles; weak coarse subangular blocky structure; very hard, friable; neutral; gradual smooth boundary.

C—48 to 72 inches, gray (10YR 6/1) silty clay loam, dark gray (10YR 4/1) moist; common medium distinct brownish yellow (10YR 6/6) mottles; massive; extremely hard, very firm; few black concretions; slightly acid.

Thickness of the A1 horizon ranges from 18 to 35 inches.

The A11 horizon is pale brown, light yellowish brown, light brown, or reddish yellow. It is stratified with lighter and darker colors. It is a loam, fine sandy loam, loamy fine sand, or silt loam and is medium acid through neutral.

The A12 horizon is pale brown, grayish brown, light brown, or light yellowish brown with or without brownish or grayish mottles. In some profiles strata of lighter or darker colors occur. The texture is mainly fine sandy loam, loam, or clay loam but in places is silt loam. The soil is slightly acid through moderately alkaline.

The Ab horizon is grayish brown, gray, light brownish gray, or pale brown with few to many yellowish, brownish, or grayish mottles. It is loam, fine sandy loam, clay loam, or silt loam and ranges from slightly acid through moderately alkaline.

The C horizon is gray, light brownish gray, grayish brown, or pale brown with few to many yellowish, brownish, or grayish mottles. It is silty clay loam, clay loam, silt loam, or loam and ranges from slightly acid through moderately alkaline.

This Kemp soil is a taxadjunct to the Kemp series. The buried horizon is not an argillic horizon as is typical for the Kemp series; otherwise, the soil is similar in morphology, use, behavior, and management.

The Kemp soils occur as broad to narrow flood plains that are subject to frequent overflow. They are associated with Tullahassee soils. Kemp soils are more loamy than Tullahassee soils in the upper 40 inches.

Kiti series

The Kiti series consists of shallow and very shallow, well drained, moderately permeable soils. These soils formed in material weathered from hard fractured limestone. They are very gently sloping to sloping and occur on ridgetops and sloping to steep hillsides. Slopes range from 1 to 20 percent.

Typical pedon of Kiti flaggy silty clay loam in an area of Kiti-Rock outcrop complex, 5 to 30 percent slopes, 1,800 feet south and 300 feet east of the northwest corner sec. 25, T. 2 S., R. 1 W.:

A11—0 to 7 inches, dark grayish brown (10YR 4/2) flaggy silty clay loam, very dark brown (10YR 2/2) moist; strong medium granular structure; hard, friable; 25 percent by volume channery fragments of limestone and 20 percent by volume flaggy fragments of limestone; moderately alkaline; gradual wavy boundary.

A12—7 to 15 inches, dark grayish brown (10YR 4/2) very flaggy silty clay loam, very dark brown (10YR 2/2) moist; strong medium granular structure; hard, friable; 45 percent by volume flaggy fragments of limestone and 20 percent by volume channery fragments of limestone; moderately alkaline; abrupt irregular boundary.

R—15 to 18 inches, hard fractured limestone.

Depth to limestone or dolomite is 4 to 20 inches.

The A horizon is dark grayish brown, grayish brown, dark brown, brown, or very dark grayish brown. It is channery or flaggy silty clay loam, clay loam, or silt loam that is 20 to 35 percent clay. It ranges from neutral through moderately alkaline.

In the A11 horizon channery fragments range from 5 to 65 percent and flaggy fragments from 5 to 65 percent by volume. In the A12 horizon channery fragments range from 5 to 60 percent and flaggy fragments from 25 to 70 percent by volume.

The R layer is hard fractured limestone or dolomite.

Kiti soils are similar to Woodford soils. Woodford soils formed in material weathered from fractured sandstone. Kiti soils are mapped with Scullin, Grainola, and Rock outcrop. They are associated with the Lawton Variant and Woodford soils.

Konawa series

The Konawa series consists of deep, well drained, moderately permeable soils formed in material weathered from mostly loamy sediments. These soils occur on nearly level to very gently sloping, broad smooth terraces and strongly sloping to moderately steep, narrow areas between different levels of terraces. Slopes range from 0 to 20 percent.

Typical pedon of Konawa fine sandy loam, 0 to 1 percent slopes, 2,540 feet north and 100 feet east of the southwest corner sec. 35, T. 2 S., R. 3 E.:

Ap—0 to 12 inches, pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; hard, very friable; strongly acid; clear smooth boundary.

B21t—12 to 30 inches, yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, friable; clay films on faces of peds; medium acid; diffuse smooth boundary.

B22t—30 to 40 inches, reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; very hard, friable; clay films on faces of peds; medium acid; diffuse smooth boundary.

B3—40 to 52 inches, reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; weak coarse prismatic structure; very hard, friable; medium acid; diffuse smooth boundary.

C—52 to 80 inches, reddish yellow (5YR 7/6) fine sandy loam, yellowish red (5YR 5/6) moist; massive; very hard, friable; medium acid.

The solum thickness is 48 to 70 inches. The A horizon is 7 to 16 inches thick.

The A1 or Ap horizon is grayish brown, light brownish gray, pale brown, or brown. The A horizon is strongly acid through slightly acid.

Some pedons have an A2 horizon that is light brownish gray, pale brown, very pale brown, or light yellowish brown.

The B23 horizon is reddish brown, reddish yellow, or yellowish red. It is slightly acid or medium acid.

The B3 horizon is reddish brown, light reddish brown, reddish yellow, or yellowish red. Texture is fine sandy loam or light sandy clay loam.

The C horizon has colors similar to the B3 horizon but includes very pale brown and pink. Texture is loamy fine sand or fine sandy loam. Reaction is neutral through strongly acid.

The Konawa soils in unit (23)—Konawa fine sandy loam, 8 to 20 percent slopes—are taxadjuncts to this series. These soils are more alkaline, but they are similar in morphology, use, and management.

Konawa soils are similar to Konsil and Duffau soils. Konsil soils developed in material weathered from soft sandstone that occurs at depths between 60 and 100 inches. Duffau soils have base saturation of 75 percent or more in some part of the argillic horizon. Konawa soils are associated with Dale, Stephenville, and Weatherford soils.

Konsil series

The Konsil series consists of deep, well drained, moderately permeable soils that formed in material weathered from mostly weakly consolidated sandstone.

Slopes are smooth and convex on broad nearly level to very gently sloping ridgetops and gently sloping to sloping hillsides. Slopes range from 0 to 8 percent.

Typical pedon of Konsil loamy fine sand, 3 to 8 percent slopes, 1,440 feet north and 120 feet east of the southwest corner sec. 35, T. 5 S., R. 2 W.:

A1—0 to 6 inches, dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; some mixing of A2 horizon colors; slightly acid; clear smooth boundary.

A2—6 to 14 inches, pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; weak fine granular structure; soft, very friable; some mixing of A1 horizon colors; slightly acid; clear smooth boundary.

B21t—14 to 27 inches, reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; weak coarse prismatic structure breaking to moderate medium subangular blocky; very hard, firm; clay films on faces of peds; medium acid; gradual smooth boundary.

B22t—27 to 36 inches, reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; common medium distinct red (2.5YR 4/6) mottles; weak coarse prismatic structure breaking to weak medium subangular blocky; very hard, firm; clay films on faces of peds; medium acid; gradual smooth boundary.

B23t—36 to 42 inches, reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; common medium distinct red (2.5YR 4/6) and light yellowish brown (10YR 6/4) mottles; weak coarse prismatic structure; very hard, firm; patchy clay films on faces of peds; few iron-manganese oxide concretions; medium acid; gradual wavy boundary.

B24t—42 to 65 inches, reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; common medium distinct pale brown (10YR 6/3) mottles; weak coarse prismatic structure; hard, friable; slightly acid; gradual wavy boundary.

C—65 to 70 inches, reddish yellow (7.5YR 6/8) weakly cemented sandstone, strong brown (7.5YR 5/8) moist; common medium distinct pale brown (10YR 6/3) mottles; slightly acid.

Thickness of solum ranges from 60 to 80 inches, and depth to rock is more than 60 inches. Soil reaction of all horizons is medium acid through mildly alkaline.

The A1 horizon is brown, grayish brown, pale brown, or dark grayish brown.

The A2 horizon is pale brown, very pale brown, light brown, or light brownish gray.

The B2t horizon is reddish brown, yellowish red, reddish yellow, or red. It has reddish or brownish mottles in most pedons. The B24t horizon is sandy clay loam or fine sandy loam.

The C horizon is weakly cemented sandstone or sandstone conglomerate or loamy fine sand.

Konsil soils are similar to Konawa and Duffau soils. Duffau soils have 75 percent or more base saturation in part of the argillic horizon. Konawa soils formed in loamy to sandy sediments on terraces. Konsil soils are associated with Eufaula, Stephenville, and Weatherford soils.

Lawton Variant

The Lawton Variant consists of deep, well drained, moderately slowly permeable soils that formed in material weathered from clays on uplands. These gently sloping soils are on hillsides. Slopes range from 3 to 5 percent.

Typical pedon of Lawton Variant clay loam, 3 to 5 percent slopes, 980 feet east and 500 feet south of the northwest corner sec. 35, T. 1 S., R. 2 W.:

A1—0 to 11 inches, very dark grayish brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; very hard, friable; few fine black concretions; neutral; gradual smooth boundary.

B21t—11 to 23 inches, reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; weak medium blocky structure; very hard, very firm; common very dark grayish brown coatings on faces of peds; distinct clay films; few fine black concretions; few cherty fragments; neutral; gradual smooth boundary.

B22t—23 to 50 inches, reddish brown (5YR 4/4) clay dark reddish brown (5YR 3/4) moist; moderate medium blocky structure; very hard, very firm; many faces of peds with dark reddish brown coatings; distinct clay films; few fine and medium black concretions; few cherty fragments; mildly alkaline; diffuse smooth boundary.

B3—50 to 80 inches, reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; weak coarse blocky structure; very hard, very firm; few bodies and streaks of reddish brown; few concretions and masses of calcium carbonate; few cherty fragments; calcareous; moderately alkaline.

Depth to rock is more than 60 inches. Secondary carbonates occur at depths of 40 to 60 inches. Chert fragments range from 0 to 5 percent in all horizons.

The A horizon is very dark grayish brown, dark brown, dark reddish gray, reddish brown, dark reddish brown, or dark grayish brown. The A horizon ranges from slightly acid through neutral. The A horizon to B horizon boundary is clear or gradual.

The B21t horizon is dark reddish brown, reddish brown, dark brown, or brown. It is clay, heavy clay loam, silty clay, or heavy silty clay loam. This horizon is neutral to mildly alkaline.

The B22t horizon is dark reddish brown, reddish brown, brown, or dark brown. It is clay or silty clay and ranges from neutral to moderately alkaline.

The B3 horizon is reddish brown or brown and is faintly mottled in some pedons. It is clay or silty clay.

The Lawton Variant is similar to Renfrow soils. Renfrow soils are more slowly permeable and have a more compact clayey subsoil than Lawton Variant soils. Scullin soils are similar to the Lawton Variant, but they have only 20 to 40 inches of solum. The associated soils are Scullin and Kiti soils.

Miller series

The Miller series consists of deep, moderately well drained, very slowly permeable, nearly level to very gently sloping soils on flood plains. Slopes are 0 to 2 percent. These soils formed in loamy or clayey alluvium under a cover of grasses and scattered trees.

Representative profile of Miller silty clay, 1,500 feet west and 500 feet north of the southeast corner sec. 35, T. 3 S., R. 3 E.:

A11—0 to 24 inches, reddish brown (5YR 4/3) silty clay, dark reddish brown (5YR 3/3) moist; weak medium blocky structure; very hard, very firm; few slickensides; calcareous; moderately alkaline; gradual wavy boundary.

A12—24 to 34 inches, brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; weak medium blocky structure; very hard, very firm; few slickensides; few bodies of reddish brown; calcareous; moderately alkaline; gradual wavy boundary.

B2—34 to 44 inches, reddish brown (5YR 4/3) silty clay, dark reddish brown (5YR 3/3) moist; weak medium blocky structure; very hard, very firm; few slickensides; few bodies of brown; calcareous; moderately alkaline; gradual wavy boundary.

C—44 to 72 inches, light reddish brown (5YR 6/4) clay loam, reddish brown (5YR 5/4) moist; massive; very hard, firm; few strata 3 to 5 inches thick of reddish brown silty clay; calcareous; moderately alkaline.

Thickness of the solum ranges from 35 to 60 inches.

The A horizon is dark reddish gray, reddish brown, or brown. In some areas 10 to 12 inches of recent deposits occur on the surface.

The B2 horizon is reddish brown, yellowish red, or brown. It is clay or silty clay.

The C horizon is light reddish brown, reddish brown, yellowish red, or brown. It is silty clay, clay loam, or clay.

Miller soils occur on narrow to wide areas on flood plains. They are associated with Yahola and Weswood soils and are similar to Watonga soils. Watonga soils have grayish colors and lack calcareous reaction in the surface layer.

Normangee series

The Normangee series consists of deep, moderately well drained, very slowly permeable, very gently sloping to gently sloping soils on uplands. Slopes range from 3 to 5 percent. These soils developed in clays or partly weathered shales under native grasses and scattered trees.

Representative profile of Normangee loam, 2 to 5 percent slopes, eroded, 60 feet south and 300 feet west of the northeast corner sec. 8, T. 3 S., R. 1 E.:

Ap—0 to 6 inches, grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; very hard, friable; slightly acid; clear smooth boundary.

B21t—6 to 27 inches, brown (10YR 5/3) clay, brown (10YR 4/3) moist; common medium distinct mottles of yellowish red (5YR 5/6); moderate medium blocky structure; extremely hard, extremely firm; clay films and grayish brown (10YR 5/2) coatings on many faces of peds; some black concretions and cherty gravel; medium acid; gradual wavy boundary.

B22t—27 to 55 inches, brown (10YR 5/3) clay, brown (10YR 4/3) moist; few medium faint mottles of yellowish brown (10YR 5/4); weak medium blocky structure; extremely hard, extremely firm; clay films and a few grayish brown (10YR 5/2) coatings on faces of peds; few slickensides; few black concretions; few fine masses and concretions of calcium carbonate; some chert gravel; moderately alkaline; gradual wavy boundary.

C—55 to 80 inches, brownish yellow (10YR 6/6) clay, yellowish brown (10YR 5/6) moist; many medium distinct mottles of gray (10YR 6/1); massive; extremely hard, extremely firm; few masses and concretions of calcium carbonate; some black concretions and chert gravel; moderately alkaline.

Thickness of the solum is more than 40 inches.

The A horizon is brown, grayish brown, dark grayish brown, pale brown, light yellowish brown, or yellowish brown. In most areas it is loam, and in some it is clay loam or silt loam. It is medium acid through neutral.

The B21t horizon is brown, grayish brown, yellowish brown, reddish brown, or yellowish red. It contains brownish or reddish mottles. It is clay or silty clay and medium acid through neutral.

The B22t horizon is brown, yellowish brown, brownish yellow, light olive brown, reddish yellow, light yellowish brown, or olive yellow. It contains brownish, yellowish, or grayish mottles. It is clay or silty clay and neutral through moderately alkaline.

The C horizon is clay or partly weathered shales. It is similar in color to the B22t horizon. It contains brownish, yellowish, or grayish mottles. In some profiles it is calcareous.

Normangee soils occur on broad upland areas of smooth ridge crests and side slopes. They are associated with Durant, Grainola, and Steedman soils. Similar soils are Renfrow, Durant, and Steedman soils. Renfrow and Durant soils have a dark colored surface layer more than 10 inches thick. Steedman soils have a solum less than 40 inches thick.

Pulaski series

The Pulaski series consists of deep, well drained, moderately rapidly permeable, nearly level or very gently sloping soils on flood plains. Slopes are 0 to 2 percent. The soils formed in recent deposits of loamy or sandy alluvium under a cover of trees.

Representative profile of the Pulaski fine sandy loam, 1,250 feet west and 300 feet south of the northeast corner sec. 26, T. 5 S., R. 3 W.:

A1—0 to 8 inches, light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; hard, very friable; medium acid; clear smooth boundary.

AC—8 to 24 inches, reddish brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, very friable; medium acid; gradual smooth boundary.

C—24 to 60 inches, reddish yellow (5YR 6/8) fine sandy loam, yellowish red (5YR 4/8) moist; massive; slightly hard, very friable; few thin strata of darker soil; medium acid.

Thickness of the soil ranges from 12 to 42 inches.

The A1 horizon is brown, grayish brown, light brownish gray, pale brown, reddish brown, or light brown. It is fine sandy loam or loam with or without strata of sandier or more clayey layers. It is medium acid through neutral.

The AC and C horizons are brown, pale brown, light brown, reddish yellow, reddish brown, or light reddish brown. The AC horizon is fine sandy loam or loam and medium acid through neutral. The C horizon is fine sandy loam, loamy fine sand, or loam and medium acid through moderately alkaline. Stratification can occur in any layer.

Pulaski soils occur on mostly narrow flood plains that are occasionally or frequently flooded for brief periods. They are associated with Bunyan and Elandco soils and are similar to Yahola, Weswood, and Bunyan soils. Yahola soils are calcareous throughout. Weswood and Bunyan soils have more than 18 percent clay in the upper 40 inches.

Renfrow series

The Renfrow series consists of deep, well drained, very slowly permeable upland soils that formed in material weathered from clay. These very gently sloping or gently sloping soils occur in broad valleys or on hillsides. Slopes range from 1 to 5 percent.

Typical pedon of Renfrow silt loam, 1 to 3 percent slopes, 2,200 feet east and 1,500 feet north of the southwest corner sec. 33, T. 5 S., R. 3 W.:

A1—0 to 8 inches, reddish brown (5YR 4/3) silt loam, dark reddish brown (5YR 3/3) moist; moderate medium granular structure; hard, friable; slightly acid; gradual smooth boundary.

B1—8 to 12 inches, reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; weak medium blocky structure; very hard, firm; few fine reddish concretions; slightly acid; gradual smooth boundary.

B21t—12 to 30 inches, reddish brown (5YR 5/4) clay, dark reddish brown (5YR 4/4) moist; moderate medium blocky structure; extremely hard, extremely firm; few peds stained with dusky red; distinct clay films on faces of peds; few black concretions; mildly alkaline; gradual smooth boundary.

B22t—30 to 42 inches, red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; moderate medium blocky structure; extremely hard, extremely firm; few slickensides; distinct clay films on faces of peds; few fine black concretions; few fine powdery masses of calcium carbonate near lower boundary; moderately alkaline; gradual smooth boundary.

B3—42 to 65 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; few medium distinct mottles and bodies of light reddish brown (5YR 6/3) and reddish yellow (5YR 6/6); weak coarse blocky structure; extremely hard, extremely firm; common soft powdery masses of calcium carbonate; calcareous; moderately alkaline.

Solum thickness is more than 60 inches.

The A1 horizon is reddish gray, dark reddish gray, reddish brown, brown, dark brown, grayish brown, or dark grayish brown. It is silt loam but includes minor areas of loam. Reaction is slightly acid through neutral.

The B1 horizon is reddish gray, dark reddish gray, reddish brown, brown, or dark brown silty clay loam or clay loam. Where colors are 4 chroma, thickness of the A1 horizon exceeds 10 inches. Reaction is slightly acid through mildly alkaline.

The B2t horizon is reddish brown, red, or yellowish red. It is clay or silty clay. Reaction is slightly acid through moderately alkaline.

The B3 horizon is red or yellowish red. Texture is clay or silty clay. Reaction is mildly alkaline through moderately alkaline.

Renfrow soils are similar to Durant, Steedman, and Normangee soils. Durant soils have a subsoil with hues of 7.5YR or more yellow. Steedman and Normangee soils have less than 10 inches of dark colors in the upper part of the profile or lack mollic epipedons. Renfrow soils are associated with Zaneis and Chickasha soils and the Lawton Variant.

Scullin series

The Scullin series consists of moderately deep, well drained, moderately slowly permeable, very gently sloping to sloping soils on uplands. The soils formed in material weathered from limestone under a cover of prairie grasses. Slopes range from 1 to 8 percent.

Representative profile of the Scullin soil in an area of Scullin-Kiti complex, 1 to 8 percent slopes, 250 feet east and 300 feet north of the southwest corner sec. 15, T. 1 S., R. 2 W.:

A1—0 to 11 inches, grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; very hard, friable; contains 5 percent by volume flaggy fragments of limestone; slightly acid; gradual smooth boundary.

B1—11 to 18 inches, reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; weak medium blocky structure; very hard, firm; thin clay films on faces of peds; few limestone fragments; slightly acid; gradual smooth boundary.

B21t—18 to 28 inches, reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate medium blocky structure; extremely hard, very firm; thin clay films on faces of peds; few limestone fragments; slightly acid; gradual wavy boundary.

B22t—28 to 34 inches, reddish brown (5YR 5/4) flaggy clay, reddish brown (5YR 4/4) moist; weak coarse blocky structure; extremely hard, very firm; thin clay films on faces of peds; contains 15 percent by volume flaggy limestone fragments; calcareous; moderately alkaline; abrupt wavy boundary.

R—34 to 44 inches, limestone bedrock, fractured at 3 to 12 inch intervals.

Depth to bedrock is 20 to 40 inches.

The A1 horizon is brown, dark brown, grayish brown, or dark grayish brown gravelly silt loam, gravelly clay loam, silt loam, or clay loam. Gravel content ranges from about 3 to 10 percent. The soil is medium acid through slightly acid.

The B1 or B21t horizon is brown, dark brown, reddish yellow, reddish brown, yellowish red, or red. It is gravelly or flaggy clay loam, gravelly or flaggy clay, clay loam, or clay, with 35 to 45 percent clay and few to 15 percent limestone fragments. It is medium acid through mildly alkaline.

The B22t horizon is similar in color and clay content to the B21t horizon. It has 5 to 34 percent fragments of limestone and is slightly acid through moderately alkaline.

Scullin soils occur on smooth to gently undulating ridge crests and side slopes. They are associated with Kiti soils and the Lawton Variant. Similar soils are Lawton Variant soils, which have a solum more than 60 inches thick.

Steedman series

The Steedman series consists of moderately deep, moderately well drained, slowly permeable, sloping to moderately steep soils on uplands. These soils formed in material weathered from shale or shaly clay under a cover of prairie grasses. Slopes range from 5 to 20 percent. The water table is perched during the rainy seasons to within 1 foot of the surface.

Representative profile of Steedman clay loam, 5 to 20 percent slopes, 1,000 feet east and 35 feet north of the southwest corner sec. 21, T. 3 S., R. 2 E.:

A1—0 to 4 inches, grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; very hard, firm; few siltstone fragments; neutral; clear smooth boundary.

B21t—4 to 11 inches, brown (10YR 5/3) clay, brown (10YR 4/3) moist; weak medium blocky structure; extremely hard, very firm; clay films on faces of peds; few bodies and coatings of grayish brown on faces of peds; few slickensides; slightly acid; gradual wavy boundary.

B22t—11 to 25 inches, olive (5Y 5/3) clay, olive (5Y 4/3) moist; weak medium blocky structure; extremely hard, extremely firm; clay films on faces of peds; few bodies and coatings of grayish brown on faces of peds; few slickensides; neutral; gradual wavy boundary.

B3—25 to 36 inches, pale olive (5Y 6/3) clay, olive (5Y 5/3) moist; few medium faint mottles of olive yellow (5Y 6/6); weak coarse blocky structure; extremely hard, extremely firm; patchy clay films on faces of peds; few slickensides; 5 percent by volume masses and concretions of calcium carbonate; moderately alkaline; gradual wavy boundary.

C—36 to 50 inches, laminated layers of pale olive (5Y 6/3) hard shale and olive (5Y 5/6) clayey shale; massive; extremely hard, extremely firm; calcareous; moderately alkaline.

Depth to shale ranges from 20 to 40 inches.

The A horizon is grayish brown, brown, or dark grayish brown. It is medium acid through neutral.

The B21t horizon is reddish brown, brown, yellowish brown, or light olive brown. It is slightly acid through mildly alkaline.

The B22t horizon is brown, grayish brown, olive gray, olive, pale olive, yellowish brown, olive yellow, or light olive brown. It is neutral through moderately alkaline.

The B3 horizon has colors and textures like the B22t horizon and is mildly alkaline or moderately alkaline.

The C horizon is olive, pale olive, brownish, or yellowish shale or shaly clays.

Steedman soils occur on narrow to wide upland areas of smooth to rolling hills and side slopes. They are associated with Grainola, Normangee, and Durant soils.

Similar soils are Renfrow, Durant, and Normangee soils, which have a solum more than 40 inches thick. Renfrow and Durant soils have more than 10 inches of a dark colored mollic epipedon in the surface layer and upper subsoil.

Stephenville series

The Stephenville series consists of moderately deep, well drained, moderately permeable, very gently sloping to sloping soils on uplands. The soils formed in material weathered from sandstone under a cover of trees and an understory of native grasses. Slopes range from 2 to 8 percent.

Representative profile of the Stephenville soil in an area of Stephenville-Darnell complex, 2 to 8 percent slopes, 2,500 feet north and 920 feet east of the southwest corner sec. 8, T. 1 S., R. 3 W.:

A1—0 to 6 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.

A2—6 to 12 inches, pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; slightly hard, very friable; slightly acid; clear wavy boundary.

B21t—12 to 20 inches, reddish brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structure; hard, firm; common peds and root channels with coatings of yellowish red; patchy clay films on faces of peds and bridging sand grains; few fine soft fragments of reddish yellow sandstone; medium acid; gradual wavy boundary.

B22t—20 to 25 inches, reddish brown (5YR 5/4) gravelly sandy clay loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; hard, firm; 15 percent by volume gravelly fragments of sandstone; medium acid; clear wavy boundary.

C—25 to 42 inches, reddish yellow (5YR 6/6) and light reddish brown (5YR 6/4) sandstone; massive; very hard, very firm; slightly acid.

Depth to sandstone is 20 to 40 inches but is mostly less than 30 inches.

The A1 horizon is reddish brown, brown, dark grayish brown, or grayish brown.

The A2 horizon is light reddish brown, pinkish gray, light brown, light brownish gray, pale brown, light yellowish brown, or very pale brown.

Texture of the A1 and A2 horizons is loamy fine sand through fine sandy loam. The A horizon is strongly through slightly acid.

The B2t horizon is reddish brown, red, yellowish red, or reddish yellow. It is fine sandy loam or sandy clay loam or gravelly sandy clay loam and strongly acid or medium acid. Some profiles have a B3 horizon similar to the B2 horizon.

The C horizon is weakly to strongly cemented sandstone of reddish to yellowish color.

Stephenville soils occur on broad to narrow ridge crests or on smooth to dissected sides of uplands. They are associated with Darnell, Windthorst, and Weatherford soils. Weatherford, Konsil, and Konawa soils are similar to Stephenville soils. All the soils are more than 40 inches deep over bedrock.

Tamford series

The Tamford series consists of deep, well drained, very slowly permeable, sloping to strongly sloping soils on uplands. These soils formed in material weathered from clays or shales under a cover of prairie grasses. Slopes range from 5 to 12 percent.

Representative profile of Tamford clay loam in an area of Tamford-Grainola complex, 5 to 12 percent slopes, 200 feet north and 70 feet west of the southeast corner sec. 33, T. 4 S., R. 3 W.:

A1—0 to 6 inches, reddish gray (5YR 5/2) clay loam, dark reddish brown (5YR 3/2) moist; weak fine blocky structure; very hard, very firm; slightly acid; clear wavy boundary.

AC1—6 to 30 inches, reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; weak coarse blocky structure; extremely hard, extremely firm; common slickensides that intersect in the lower part; few masses and concretions of calcium carbonate; reddish gray soil material in some vertical cracks; moderately alkaline; gradual wavy boundary.

AC2—30 to 54 inches, reddish brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) moist; weak coarse blocky structure; extremely hard, extremely firm; few intersecting slickensides; common masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—54 to 72 inches, red (10R 5/6) clay, red (10R 4/6) moist; massive; extremely hard, extremely firm; common bodies and thin strata of white soft sandstone and red soft shale; calcareous; moderately alkaline.

Solum thickness ranges from 40 to 60 inches to interbedded shales and clay. Intersecting slickensides occur in the upper 40 inches. The soil, if undisturbed, has microlows and microhighs that extend up and down the slope. When dry, this soil has cracks 1 to 5 centimeters wide at a depth of 20 inches. Distance between center of the microhigh and center of the microlow is 5 to 12 feet.

The A1 horizon is reddish brown, reddish gray, or dark reddish gray. It ranges from slightly acid through moderately alkaline and is noncalcareous or calcareous. The A1 horizon is clay loam, silty clay loam, or clay. Clay content is 35 to 45 percent.

The AC horizon is reddish brown or light reddish brown. Some pedons have few to common brownish or reddish mottles. Clay content is 40 to 50 percent. The soils are mildy alkaline or moderately alkaline and are calcareous in at least the lower part.

The C horizon is reddish brown, red, or light reddish brown. Some pedons have few to common brownish or yellowish mottles. Calcium carbonate concretions range from 1 to 10 percent by volume in the AC and C horizons.

Tamford soils occur on broad upland areas of smooth or dissected side slopes. They are associated with Heiden and Grainola soils. Similar soils are Clarita and Grainola soils. Grainola soils have a solum less than 40 inches thick. Clarita soils have more than 12 inches of surface layer with a grayer color.

Tullahassee series

The Tullahassee series consists of deep, somewhat poorly drained soils that are moderately rapidly permeable. These nearly level to very gently sloping soils occur on flood plains. They are subject to flooding. They formed in loamy and sandy alluvium under a cover of trees with an understory of native grasses. Slopes are 0 to 2 percent. The water table occurs at a depth of 2 to 3 feet for part of the year.

Representative profile of Tullahassee loam in an area of Kemp and Tullahassee soils, 200 feet north and 750 feet west of the southeast corner sec. 2, T. 5 S., R. 2 E.:

A11—0 to 13 inches, pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak fine granular structure; very hard, very friable; many thin strata of very pale brown and grayish brown; slightly acid; clear smooth boundary.

A12—13 to 20 inches, pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; common medium faint mottles of very pale brown (10YR 7/4); weak medium subangular blocky structure; hard, very friable; few thin strata of very pale brown and brown; slightly acid; clear smooth boundary.

AC—20 to 40 inches, very pale brown (10YR 7/4) loamy fine sand, yellowish brown (10YR 5/4) moist; common medium distinct mottles of light brownish gray (10YR 6/2); weak coarse subangular blocky structure; slightly hard, very friable; few thin strata of pale brown and light brownish gray fine sandy loam; slightly acid; clear smooth boundary.

IIAb—40 to 65 inches, grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; common medium distinct mottles of light brown (7.5YR 6/4) and gray (N 6/0); massive; very hard, friable; few thin strata of light yellowish brown; saturated with water; neutral.

The A11 horizon is pale brown, light yellowish brown, brown, or light brown, with or without brownish mottles. It is stratified with lighter or darker colors. It is loam, fine sandy loam, or loamy fine sand and medium acid through neutral.

The A12 and AC horizons have layers of loamy fine sand, fine sandy loam, loam, or clay loam. The control section averages less than 18 percent clay. It is slightly acid through moderately alkaline. The A12 horizon is pale brown, brown, light yellowish brown, or light brown, with or without brownish mottles. The colors in the AC horizon are similar to those in the A12 horizon, including very pale brown and light brownish gray with few to common brownish or grayish mottles.

The IIAb horizon is grayish brown, gray, dark gray, or light brownish gray, with brownish and grayish mottles. It is loam, fine sandy loam, or clay loam. Reaction is slightly acid through moderately alkaline.

This soil is a taxadjunct to the Tullahassee series. It is more alkaline in the lower part of the control section; otherwise it is similar in morphology, use, behavior, and management.

Tullahasse soils are associated with Kemp soils. Kemp soils have a more loamy texture in the upper 40 inches and are moderately alkaline.

Watonga series

The Watonga series consists of deep, moderately well drained, very slowly permeable soils that formed in material weathered from clayey alluvium. The nearly level Watonga soils are on broad smooth flood plains of larger streams. Slopes are 0 to 1 percent.

Typical pedon of Watonga silty clay, 1,280 feet south and 1,400 feet east of the northwest corner sec. 31, T. 3 S., R. 2 E.:

Ap—0 to 4 inches, dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate fine blocky structure; extremely hard, very firm; mildly alkaline; clear wavy boundary.

A1—4 to 24 inches, dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; weak medium blocky structure; extremely hard, very firm; few slickensides near lower boundary; moderately alkaline; gradual wavy boundary.

AC—24 to 55 inches, dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; extremely hard, extremely firm; few intersecting slickensides; many shiny pressure faces; few cracks filled with dark gray soil material from overlying layer; common soft masses and concretions of calcium carbonate; moderately alkaline; gradual wavy boundary.

C—55 to 80 inches, brown (10YR 4/3) silty clay, dark brown (10YR 3/3) moist; massive; extremely hard, extremely firm; few dark grayish brown and dark gray bodies of silty clay; common fine to medium soft masses and concretions of calcium carbonate; moderately alkaline.

The A and AC horizons combined are 40 to 60 inches thick. Intersecting slickensides occur within 20 to 40 inches of the soil surface. Distance between center of the microhigh and center of the microlow is 8 to 12 feet.

The upper part of the A horizon is silty clay or silty clay loam. The lower part of the A horizon is silty clay and clay. Color of the A1 horizon is dark gray, very dark gray, and gray. In some pedons the lower part of the thicker A1 horizons has very dark grayish brown, grayish brown, and dark brown colors. Reaction ranges from neutral through moderately alkaline. The A horizon is 12 inches thick in the microhighs and 40 inches thick in the microlows.

The AC horizon is brown, dark brown, dark grayish brown, dark yellowish brown, or yellowish brown. It is mildly alkaline to moderately alkaline. The AC horizon contains secondary carbonates and is calcareous in some pedons. Cracks in the AC horizon are commonly filled with colors like the A1 horizon.

The C horizon is reddish brown, brown, dark grayish brown, grayish brown, dark yellowish brown, or yellowish brown. In some pedons it has reddish or brownish mottles. It is moderately alkaline and in most areas is calcareous in some part.

Watonga soils are similar to the Burleson and Heiden soils. Burleson soils have colors with a chroma of less than 1.5 to depths of 40 inches or more and are on uplands. Heiden soils are on uplands and have brownish colors beginning at depths of 12 inches or less. Associated soils are Healdton and Miller soils.

Weatherford series

The Weatherford series consists of deep, well drained, moderately permeable soils on uplands. The soils formed in material weathered from sandstone. Weatherford soils are on ridgetops and hillsides. Slopes are very gently sloping to strongly sloping and range from 1 to 12 percent.

Typical pedon of Weatherford fine sandy loam, 1 to 3 percent slopes, 50 feet west and 750 feet north of the southeast corner sec. 21, T. 3 S., R. 1 W.:

Ap—0 to 6 inches, grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, very friable; slightly acid; clear smooth boundary.

A2—6 to 8 inches, pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; hard, very friable; slightly acid; clear smooth boundary.

B21t—8 to 28 inches, yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to moderate coarse subangular blocky; very hard, firm; patchy clay films on faces of peds; medium acid; gradual wavy boundary.

B22t—28 to 46 inches, reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; weak coarse prismatic structure parting to moderate coarse subangular blocky; very hard, firm; patchy clay films on faces of peds; medium acid; gradual wavy boundary.

B3—46 to 50 inches, reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; few medium distinct mottles of light brown (7.5YR 6/4) and prominent mottles of red (2.5YR 4/6); weak coarse prismatic structure parting to weak coarse subangular blocky; very hard, firm; few red gravelly sandstone fragments; medium acid; clear wavy boundary.

C—50 to 60 inches, reddish yellow (7.5YR 6/6) and reddish brown (5YR 4/4) soft sandstone; few thin interbedded layers of reddish yellow (7.5YR 6/6) sandy clay loam; slightly acid.

Depth to sandstone is 40 to 60 inches.

The A1 or Ap horizon is pale brown, brown, light brownish gray, grayish brown, or reddish brown.

The A2 horizon has similar colors but includes very pale brown or yellowish brown. The A horizon is medium acid to neutral.

The B2t horizon is reddish yellow, yellowish red, or red. Brownish or reddish mottles occur in some pedons. The soil is neutral through strongly acid.

The B3 horizon has colors similar to the those of the B2t horizon and has none to common brownish to reddish mottles. It is medium acid through neutral. Less than 10 percent is fragments of sandstone less than 3 inches in diameter. Some pedons lack a B3 horizon.

The C horizon is weakly cemented sandstone.

Weatherford soils are similar to Konsil, Konawa, and Stephenville soils. Konsil and Konawa soils are more than 60 inches deep. Stephenville soils are 20 to 40 inches deep. Associated soils are Darnell, Duffau, Stephenville, and Windthorst soils.

Weswood series

The Weswood series consists of deep, well drained, moderately permeable, nearly level soils of the flood plains. The soils formed in loamy alluvium under a cover of trees. They occur as narrow to wide elongated areas near the major streams. Slopes are 0 to 1 percent.

Typical profile of Weswood silt loam, 1,550 feet east and 75 feet north of the southwest corner sec. 17, T. 3 S., R. 3 E.:

Ap—0 to 6 inches, light brown (7.5YR 6/4) silt loam, brown (7.5YR 4/4) moist; weak medium granular structure; very hard, friable; calcareous; moderately alkaline; clear smooth boundary.

AC—6 to 40 inches, light brown (7.5YR 6/4) silt loam, brown (7.5YR 4/4) moist; weak medium subangular blocky structure; very hard, friable; few 1/2 inch to 2 inch strata of pink (7.5YR 7/4) fine sandy loam; calcareous; moderately alkaline; gradual smooth boundary.

C—40 to 80 inches, light brown (7.5YR 6/4) silt loam, brown (7.5YR 4/4) moist; massive; hard, friable; common 1 inch to 4 inch strata of brown (10YR 5/3) fine sandy loam; calcareous; moderately alkaline.

Thickness of the solum ranges from 30 to 60 inches.

The Ap and AC horizons are reddish brown, yellowish red, light brown, or brown. Thin strata include fine sandy loam, loam, or clay loam.

The C horizon has colors similar to those of the A or AC horizons, including reddish yellow. In most areas it is silt loam, loam, or fine sandy loam, but in some it is silty clay loam.

This soil is a taxadjunct to the Weswood series because Weswood soils typically have well expressed cambic horizons; otherwise, it has similar morphology and behavior.

Weswood soils occur on occasionally flooded flood plains associated with Yahola and Miller soils. Similar soils are Pulaski, Bunyan, and Yahola soils, which have less silty textures than Weswood soils. Pulaski and Yahola soils are less than 18 percent clay in the upper 40 inches and are moderately rapidly permeable.

Wilson series

The Wilson series consists of deep, somewhat poorly drained, very slowly permeable soils on prairie uplands. These nearly level to very gently sloping soils developed in material weathered from clays or shaly clays in broad smooth valleys and on hillsides. Slopes are 0 to 3 percent. A water table is perched at a depth of 0 to 1 foot for about 6 months.

Representative pedon of Wilson silt loam, 0 to 1 percent slopes, 650 feet east and 350 feet south of the northwest corner sec. 13, T. 3 S., R. 1 E.:

Ap—0 to 8 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; massive when dry, moderate fine granular structure when moist; hard, friable; medium acid; abrupt smooth boundary.

B21t—8 to 26 inches, very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; moderate medium blocky structure; extremely hard, extremely firm; distinct clay films; few slickensides; few cherty fragments; neutral; gradual smooth boundary.

B22t—26 to 52 inches, grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate medium blocky structure; extremely hard, extremely firm; distinct clay films; few slickensides; few cherty fragments; few masses and concretions of calcium carbonate; moderately alkaline; gradual smooth boundary.

B3—52 to 80 inches, reddish yellow (7.5YR 6/6) clay, strong brown (7.5YR 5/6) moist; common medium distinct mottles of grayish brown (10YR 5/2) and brownish yellow (10YR 6/6); weak coarse blocky structure; extremely hard, extremely firm; few slickensides; few cherty fragments; few masses and concretions of calcium carbonate; moderately alkaline.

Solum thickness is more than 60 inches. Cracks more than 1 centimeter wide extend from the surface to a depth of 2 to 4 feet during the dry season.

The A horizon is gray, dark gray, grayish brown, or dark grayish brown. It is medium acid to neutral.

The B21t horizon is very dark gray, dark gray, or gray. In some profiles it has brownish or yellowish mottles. It is silty clay or clay and neutral or slightly acid.

The B22t horizon is grayish brown, dark grayish brown, brown, or dark brown. It is silty clay or clay that is neutral to moderately alkaline.

The B3 horizon is reddish yellow, yellowish red, dark brown, brown, yellowish brown, or dark yellowish brown. It is clay, silty clay, clay loam, or silty clay loam and has secondary carbonates.

Wilson soils are similar to Healdton soils, which are on flood plains and have high concentrations of sodium salts in the subsoil. Associated soils are Burleson and Heiden soils.

Windthorst series

The Windthorst series consists of deep, moderately well drained, moderately slowly permeable, very gently sloping to moderately steep soils on uplands. These soils formed in material weathered from mostly clays or shaly clays under a cover of trees and an understory of native grasses. Slopes range from 1 to 20 percent.

Representative profile of Windthorst fine sandy loam, 1 to 3 percent slopes, 1,900 feet east and 65 feet south of the northwest corner sec. 14, T. 4 S., R. 2 W.:

A1—0 to 5 inches, grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.

A2—5 to 11 inches, very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; weak fine granular structure; slightly hard, very friable; medium acid; abrupt smooth boundary.

B21t—11 to 25 inches, reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate medium blocky structure; extremely hard, very firm; few faces of peds with very pale brown coatings; distinct clay films on faces of peds; few fine black concretions; medium acid; gradual smooth boundary.

B22t—25 to 34 inches, light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; few medium faint mottles of brownish yellow (10YR 6/6); weak medium blocky structure; extremely hard, very firm; distinct clay films on faces of peds; few medium black concretions and gravelly fragments; mildly alkaline; gradual smooth boundary.

B3t—34 to 54 inches, brownish yellow (10YR 6/6) clay, yellowish brown (10YR 5/4) moist; common medium distinct mottles of pale brown

(10YR 6/3); weak medium blocky structure; extremely hard, very firm; patchy clay films on faces of peds; few soft masses of calcium carbonate below 45 inches; few fine and medium black concretions; moderately alkaline; gradual smooth boundary.

C—54 to 65 inches, brownish yellow (10YR 6/6) sandy clay, yellowish brown (10YR 5/6) moist; common medium distinct gray (10YR 6/1) mottles; massive; extremely hard, very firm; 10 percent by volume of soft gravelly sandstone fragments; many fine black masses and concretions; moderately alkaline.

Thickness of the solum ranges from 35 to 60 inches.

The A1 horizon is grayish brown, dark grayish brown, brown, or dark brown. Colors are slightly lighter in cultivated areas. The soil is medium acid to neutral.

The A2 horizon is very pale brown, pale brown, light yellowish brown, light brownish gray, or light brown. It is dominantly fine sandy loam but in places is loam. The reaction is medium acid through neutral.

The B21t horizon is reddish brown, yellowish red, or red. It is clay or sandy clay and medium acid through slightly acid.

The B22t horizon is brownish yellow, light yellowish brown, yellowish red, or reddish yellow. It has none to common reddish, brownish, or yellowish mottles. It is clay or sandy clay and medium acid through mildly alkaline.

The B3t horizon is similar in color and texture to the B22t horizon. It has few to common brownish, reddish, or grayish mottles. It is neutral to moderately alkaline.

The C horizon is soft shale, sandy clays, or heavy clay loams, with or without interbedded layers of sandstone.

Windthorst soils occur on broad upland areas of smooth ridge crests and smooth or rocky side slopes. They are associated with Darnell, Stephenville, and Weatherford soils and are similar to Chigley soils. Chigley soils are gravelly and formed in cherty conglomerates with interbedded layers of hard shale or sandstone.

Woodford series

The Woodford series consists of very shallow to shallow, well drained, moderately permeable soils on uplands. These soils formed in material weathered from sandstone. They are on sloping ridgetops to moderately steep hillsides. Slopes range from 5 to 20 percent.

Typical pedon of Woodford silt loam, 5 to 20 percent slopes, 700 feet west of the southeast corner sec. 29, T. 2 S., R. 1 E.:

A11—0 to 7 inches, very dark gray (10YR 3/1) silt loam, black (10YR 2/1) moist; strong medium granular structure; hard, very friable; many fine roots; 15 percent by volume of fragments of sandstone greater than 3 inches in diameter and 5 percent by volume of fragments of sandstone 2 mm to 3 inches in diameter; mildly alkaline; clear wavy boundary.

A12—7 to 17 inches, dark gray (10YR 4/1) very channery silt loam, very dark gray (10YR 3/1) moist; strong medium granular structure; hard, very friable; many fine roots; 40 percent by volume of fragments of sandstone greater than 3 inches in diameter and 25 percent by volume of fragments of sandstone 2 mm to 3 inches in diameter; mildly alkaline; abrupt wavy boundary.

R—17 to 20 inches, brown (10YR 4/3) hard fractured sandstone.

Depth to sandstone bedrock ranges from 5 to 20 inches.

The A horizon is very dark gray, very dark grayish brown, dark grayish brown, dark brown, brown, or dark gray. It ranges from slightly acid to moderately alkaline. Fragments of sandstone greater than 3 inches in diameter range from 10 to 60 percent. Fragments 2 millimeters to 3 inches in diameter range from 0 to 30 percent by volume.

The R layer is hard fractured sandstone. It is brown, yellowish brown, or brownish yellow. It is tilted from 20 to 70 degrees from horizontal.

Woodford soils are associated with and are similar to Kiti soils. Kiti soils formed in material weathered from limestone.

Yahola series

The Yahola series consists of deep, well drained, moderately rapidly permeable soils formed in slightly altered calcareous loamy alluvium. These soils are on flood plains of the Washita River. Slopes are nearly level to very gentle and range from 0 to 3 percent.

Typical pedon of Yahola fine sandy loam in an area of Yahola soils, 3,170 feet west and 150 feet south of the northeast corner sec. 12, T. 4 S., R. 3 E.:

A11—0 to 4 inches, reddish yellow (5YR 6/6) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; calcareous; moderately alkaline; clear smooth boundary.

A12—4 to 13 inches, light reddish brown (5YR 6/4) loamy fine sand, reddish brown (5YR 4/4) moist; very weak fine granular structure; soft, very friable; few bodies of fine sand; calcareous; moderately alkaline; gradual smooth boundary.

C1—13 to 38 inches, reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 4/6) moist; massive; slightly hard, very friable; few thin strata of loamy fine sand; calcareous; moderately alkaline; abrupt smooth boundary.

C2—38 to 72 inches, reddish yellow (5YR 6/6) loamy fine sand, yellowish red (5YR 4/6) moist; massive; soft, very friable; few 2 to 4 inch strata of reddish brown fine sandy loam; calcareous; moderately alkaline.

Solum thickness is 8 to 20 inches.

The A1 horizon is dominantly fine sandy loam but in places is loamy fine sand. Colors are reddish brown, light reddish brown, reddish yellow, or light brown.

The C horizon has colors similar to those of the A horizon. Texture is fine sandy loam or loam in the 10- to 40-inch control section. In the lower part of the C horizon, the texture is fine sandy loam, loam, or loamy fine sand. Thin strata of coarser or finer texture occur throughout this horizon.

Yahola soils are similar to Bunyan, Pulaski, and Weswood soils. Bunyan and Weswood soils have more loamy textures in the upper 40-inch control section. Pulaski soils are not calcareous throughout the soil. Associated soils are Miller and Weswood soils.

Zaneis series

The Zaneis series consists of deep, well drained, moderately permeable, gently sloping soils on uplands. The soils formed on hillsides and narrow ridge crests in material weathered from weakly consolidated sandstone and sandy shale under native grass. Slopes range from 3 to 5 percent.

Representative profile of Zaneis loam, 3 to 5 percent slopes, 90 feet west and 1,100 feet south of the northeast corner sec. 6. T. 5 S., R. 3 W.:

A1—0 to 12 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable; neutral; gradual smooth boundary.

B1—12 to 27 inches, reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; weak medium subangular blocky structure; hard, friable; few fine black concretions; neutral; gradual smooth boundary.

B2t—27 to 39 inches, reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; very hard, firm; clay films on faces of peds; common medium and fine black concretions; medium acid; gradual smooth boundary.

B3—39 to 48 inches, red (2.5YR 5/6) clay loam, red (2.5YR 4/6) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; very hard, firm; many black masses and concretions; few gravelly sandstone fragments; slightly acid; clear wavy boundary.

C—48 to 72 inches, red (2.5YR 5/6) sandy shale, red (2.5YR 4/6) moist; massive; extremely hard, very firm; few medium black masses and concretions; slightly acid.

Thickness of the soil is 40 to 60 inches.

The A horizon is grayish brown, brown, or dark grayish brown. It is medium acid through neutral.

The B1 horizon is brown, dark brown, or reddish brown. It is loam, sandy clay loam, or clay loam and medium acid through neutral.

The B2t and B3 horizons are reddish brown, yellowish red, red, or reddish yellow. They are clay loam or sandy clay loam. Reaction is medium acid through mildly alkaline.

The C horizon is similar in color to the B horizon. It is alternating layers of consolidated sandstone and sandy shales. It is slightly acid through mildly alkaline.

Zaneis soils are similar to Chickasha soils. Chickasha soils have more yellowish hues in the upper part of the B horizon. Zaneis soils are associated with Renfrow and Chickasha soils.

Formation of the soils

In this section the factors of soil formation are discussed and related to the soils in the survey area. In addition, the processes of soil formation are described.

Factors of soil formation

The properties of the soil at any given place are the result of the integrated effects of five major factors of soil formation—parent material, climate, plant and animal life, relief, and time. Few generalizations can be made regarding the effect of any one factor because the effect of each is modified by the other four.

Parent material.—Parent material, one of the most influential factors of soil formation in the county, sets the limits of the chemical and mineralogical composition of the soil and influences the rate of soil development. Parent material is the unconsolidated material from which soil forms.

Carter County has several kinds of parent material, each of which produces a different soil. Soils formed in material weathered from shale, such as Steedman soils, have a clayey subsoil. Those formed in material weathered from sandstone, such as Stephenville soils, have a loamy subsoil. Soils formed in material weathered from limestone, such as Kiti soils, have an adequate supply of bases. Examples of soils formed in clayey, loamy, or sandy sediments are Burleson, Dale, and Eufaula soils.

Climate.—The moist, subhumid continental climate of Carter County is characterized by rains of high intensity. Moisture and warm temperatures have been sufficient to promote the formation of distinct horizons in many of the soils. Differences in soils cannot be attributed to climate because the climate is uniform throughout the county. Heavy rains have caused rapid runoff that has eroded many of the soils. This erosion is an indirect effect of climate.

Plants and animals.—Plants, burrowing animals, insects, and soil micro-organisms have a direct influence on the formation of soil. Native vegetation, such as trees or grasses, or a combination of both, determines to a large extent the amount of organic matter, the amounts and kinds of plant nutrients, and the type of soil structure and consistence. Durant and Zaneis soils formed under native grasses. The fibrous roots of these native grasses promote a good granular structure and a high organic matter content. This type of vegetation reduces loss of soil nutrients by the recycling and by the feeding ability of the deep grass roots. Consequently, the soils that formed under grass in Carter County tend to have more bases and organic matter than the soils that formed under trees. Stephenville and Konsil soils formed under trees and are therefore lower in plant nutrients and organic matter content than, for example, Durant and Zaneis soils.

During the past century, man has altered this soil-forming process by removing the native vegetation throughout much of the county. Lack of adequate conservation measures has resulted in much soil loss through sheet and gully erosion. In areas where part of the surface layer has been removed and gullies have formed, eroded or gullied phases of soils are mapped. An example is Konsil and Weatherford soils, gullied.

Relief.—Relief affects soil formation through its influence on moisture, drainage, erosion, temperature, and plant cover. The relief of Carter County is determined largely by the resistance of the underlying parent material to weathering and geologic erosion.

The effect of relief on soil formation is illustrated by two different soils, Scullin and Kiti, both of which formed in material weathered from limestone under a cover of grasses. Because Scullin soils generally are in areas of less sloping relief, they have less surface runoff and more water percolating through the soil to influence the loss, gain, or transfer of soil constituents. Kiti soils typically are in areas of more sloping relief and have a less clearly defined profile than Scullin soils. On the more sloping soils, more of the rainwater runs off instead of moving through the soil to help in the formation of a deeper solum.

Time.—Time as a factor cannot be measured strictly in years. The length of time needed for the development of genetic horizons depends on the intensity and interactions of the soil-forming factors.

Processes of soil formation

Active processes that have influenced the formation of horizons in the soils of Carter County are (1) accumulation of organic matter, (2) leaching of calcium carbonates and bases, and (3) translocation of silicate clay minerals. In most soils, more than one of these processes have been active in the development of the horizons.

The addition of organic matter by native grasses has contributed to the granular structure of the surface layer. Durant soils, for example, have a granular surface layer high in organic matter content. Konsil soils, which formed under trees, have less organic matter than Durant soils.

Leaching of carbonates and bases is active in the formation of soils. The accumulation of calcium carbonates and bases in the lower part of the B horizon of Durant soils indicates the depth to which water has percolated. Konsil soils have been leached to the extent that no calcium carbonate has accumulated. The strong leaching of bases from the B horizon is reflected by the base saturation of those soils.

Soils on flood plains, such as Weswood and Yahola, are recharged with bases when flooding occurs. The more acid Pulaski soils, which formed in neutral to acid soil material, have not been leached. Heiden soils, which formed over weathered shale beds and clayey sediments, are high in carbonates. The calcium carbonate in Heiden soils is related to the nature of the parent materials.

The translocation of silicate clay minerals is important in establishing the properties and classification of soils. Argillic horizons are diagnostic for classification. Clay films on ped surfaces, bridging sand grains, and increases in total clay are evidence of argillic horizons. The argillic horizon occurs in many soils, for example, Chickasha, Durant, and Renfrow soils. The varying degrees of translocation of silicate clay minerals and the kinds of parent material have resulted in wide variation in the texture and other properties in the argillic horizons of soils. Eufaula and Konsil soils have a subsurface layer that is more intensely leached of silicate clay minerals than the surface layer of other soils in the county.

The grasses on the soils bring bases to the surface and thus retard leaching and the formation of an A2 horizon. Geologic erosion on such soils as Kiti hinders horizon development through soil losses. The sediment of Yahola, Pulaski, and other soils on flood plains was deposited so recently that there has not been enough time for the formation of distinct horizons.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 40-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 2
Low	2 to 4
Moderate	4 to 6
High	More than 6

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Broad-base terrace. A ridge-type terrace built to control erosion by diverting runoff along the contour at a nonscouring velocity. The terrace is 10 to 20 inches high and 15 to 30 feet wide and has gently

sloping sides, a rounded crown, and a dish-shaped channel along the upper side. It may be nearly level or have a grade toward one or both ends.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Channery soil. A soil, that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A mapping unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Compressible. Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops

cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Erosion pavement. A layer of gravel or stones that remains on the ground surface after fine particles are removed by wind or water. Desert pavements result from wind erosion in arid areas.

Excess alkali. Excess exchangeable sodium. The resulting poor physical properties restrict the growth of plants.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime. Excess carbonates. Excessive carbonates, or lime, restrict the growth of some plants.

Excess salts. Excess water soluble salts. Excessive salts restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May,* for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Gypsum. Hydrous calcium sulphate.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or

browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hummocky. Refers to a landscape of hillocks, separated by low sags, having sharply rounded tops and steep sides. Hummocky relief resembles rolling or undulating relief, but the tops of ridges are narrower and the sides are shorter and less even.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants are those that follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. Inadequate strength for supporting loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy textured) soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Narrow-base terrace. A terrace no more than 4 to 8 feet wide at the base. A narrow-base terrace is similar to a broad-base terrace, except for the width of the ridge and channel.

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Pan. A compact, dense layer in a soil. A pan impedes the movement of water and the growth of roots. The word "pan" is commonly combined with other words that more explicitly indicate the nature of the layer; for example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water of subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Polypedon. A volume of soil having properties within the limits of a soil series, the lowest and most homogeneous category of soil taxonomy. A "soil individual."

Poorly graded. Refers to soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land supporting some forest trees.

Range condition. The health or productivity of forage plants on a given range, in terms of the potential productivity under normal climate and the best practical management. Condition classes generally recognized are—*excellent*, *good*, *fair*, and *poor*. The classification is based on the percentage of original, or assumed climax vegetation on a site, as compared to what has been observed to grow on it when well managed.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind and amount of native vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock. Soil scientists regard as soil only the part of the regolith that is modified by organisms and other soil-building forces. Most engineers describe the whole regolith, even to a great depth, as "soil."

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; contains harmful salts and is strongly alkaline; or contains harmful salts and exchangeable sodium and is very strongly alkaline. The salts, exchangeable sodium, and alkaline reaction are in the soil in such location that growth of most crop plants is less than normal.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Saprolite (geology). Soft, earthy, clay-rich, thoroughly decomposed rock formed in place by chemical weathering of igneous and metamorphic rock. In soil survey, the term saprolite is applied to any unconsolidated residual material underlying the soil and grading to hard bedrock below.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-alumina ratio. The molecular ratio of silica to alumina in soil, clay, or any alumino-silicate mineral.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Sinkhole. A depression in a landscape where limestone has been locally dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. Locally, a small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake. The slow movement of water into the soil.

Slow refill. The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.005 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solodized soil. A formerly alkali (sodic) soil that has been leached so that it has become acid and has a thick, gray upper layer over an acid, blocky B horizon. The resulting soil may be termed a Soloth.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stone line. A concentration of coarse fragments in soils that generally marks an old weathering surface. In a cross section, the line may be one fragment or more thick. The line generally overlies material that weathered in place and marks the top of a paleosol. It is ordinarily overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitaion is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or " very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Trace elements. The chemical elements in soils, in only extremely small amounts, essential to plant growth. Examples are zinc, cobalt, manganese, copper, and iron.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point. The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Illustrations

Figure 1.—Profile of Chickasha loam, 1 to 3 percent slopes.

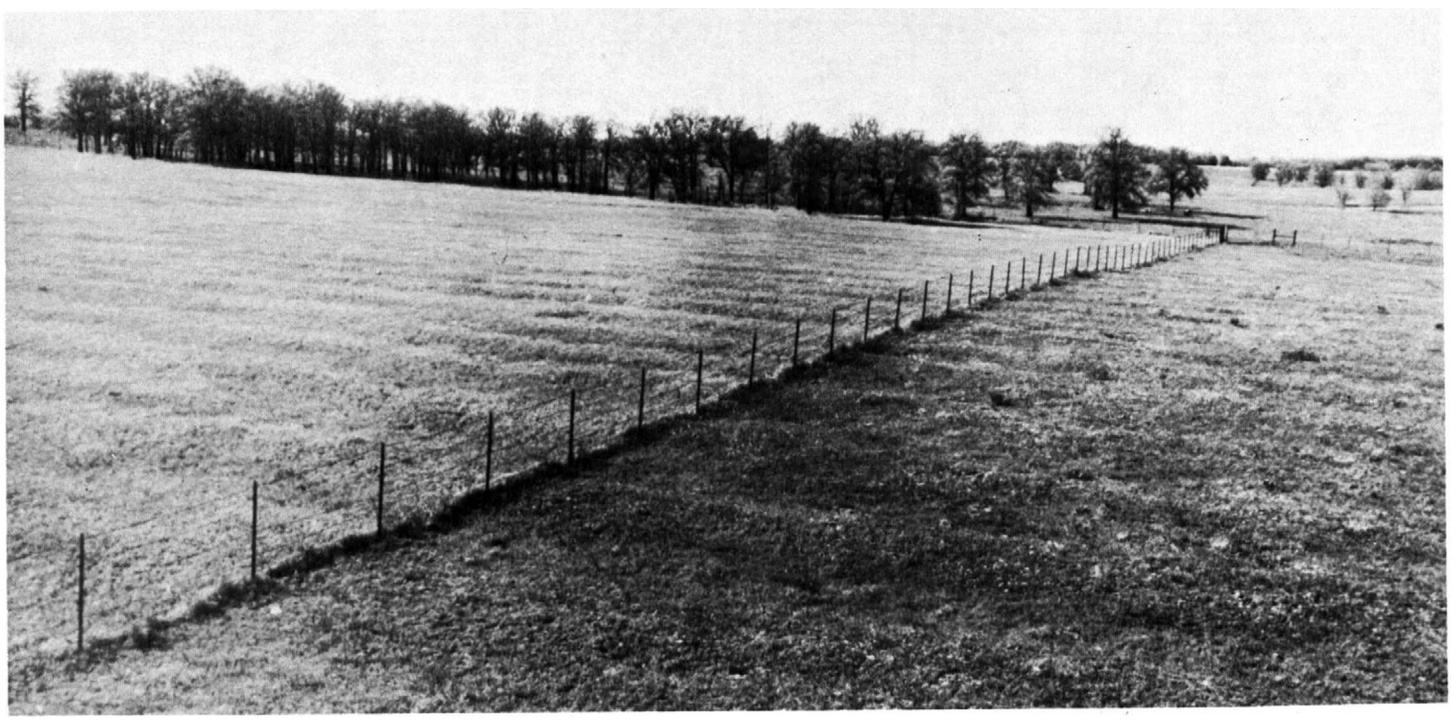

Figure 2.—Native grass meadow on Clarita soil. This Blackclay Prairie range site has gilgai microrelief.

Figure 3.—Profile of Durant loam, 3 to 5 percent slopes.

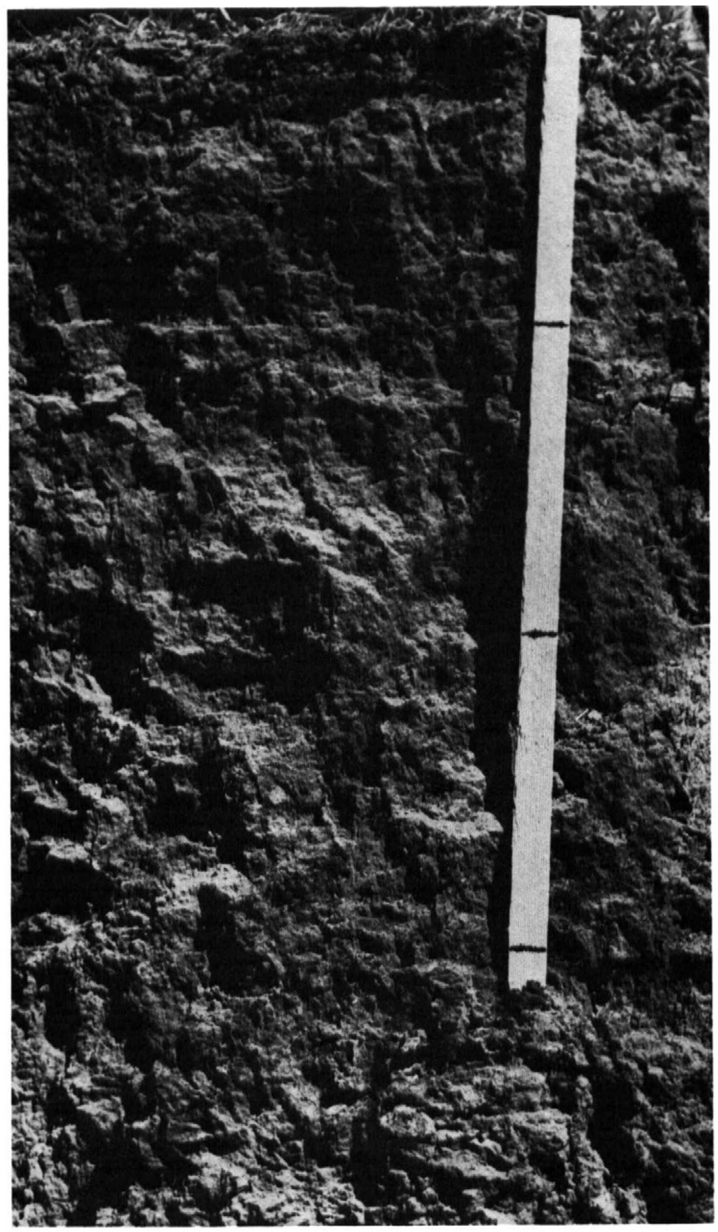

Figure 4.—Profile of Normangee loam, 2 to 5 percent slopes, eroded.

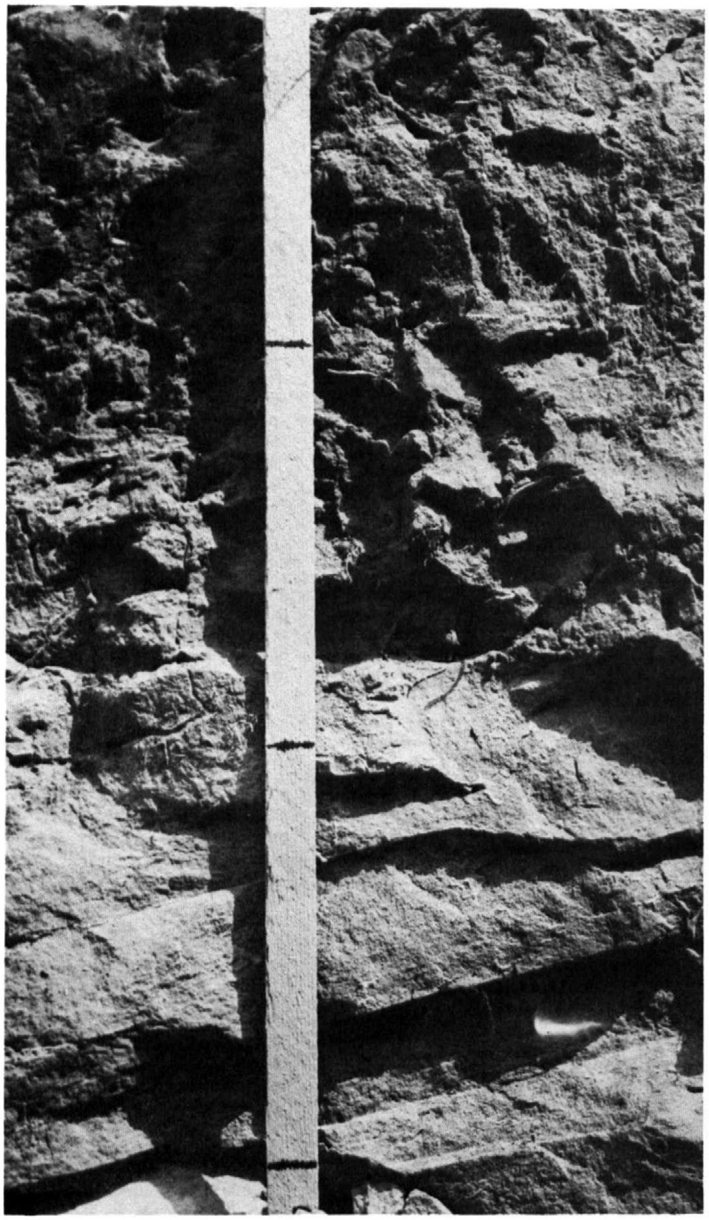

Figure 5.—Profile of the shallow Darnell soil in the Stephenville-Darnell complex.

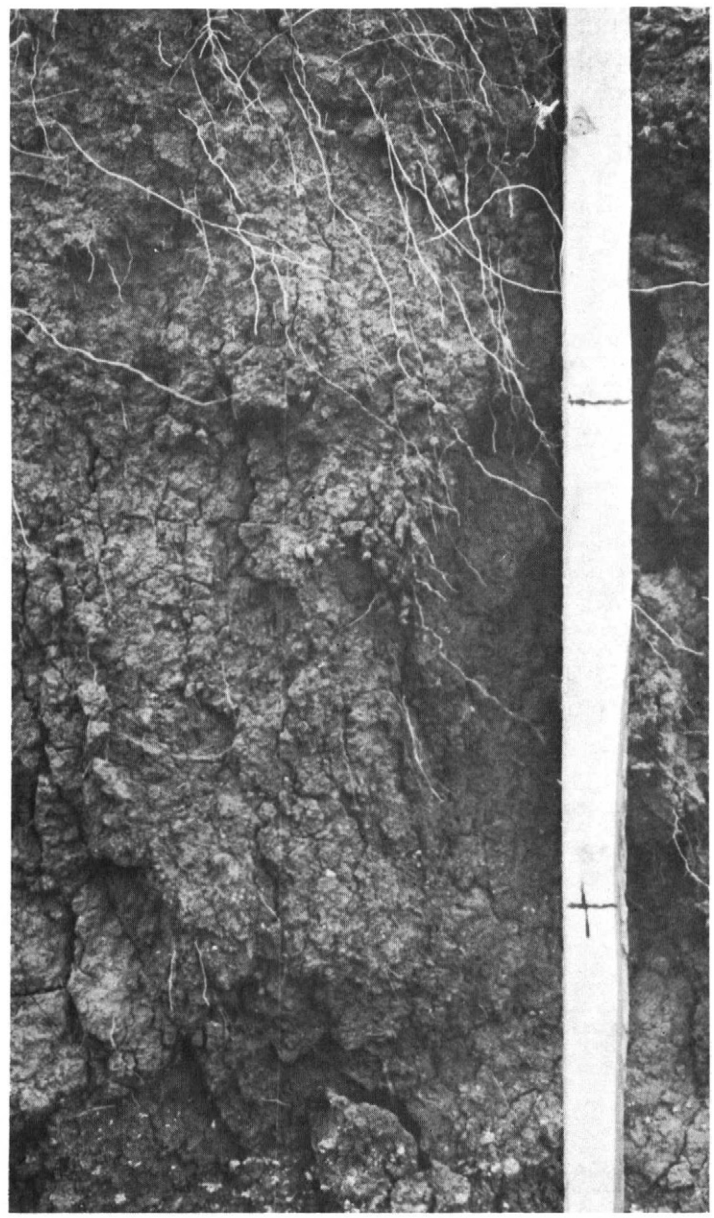

Figure 6.—Profile of the Grainola soil in the Tamford-Grainola complex.

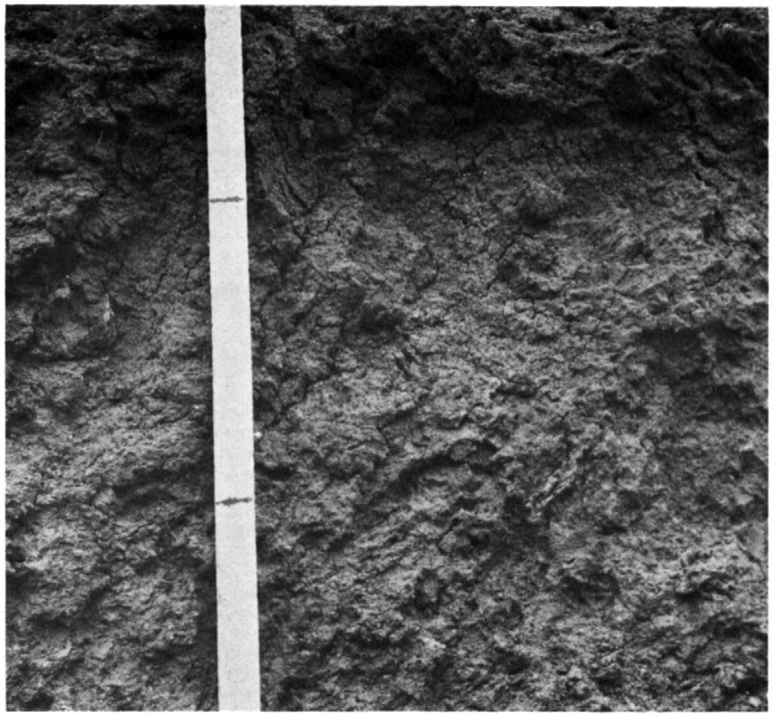

Figure 7.—Profile of Wilson silt loam, 1 to 3 percent slopes.

Figure 8.—Typical area of the Windthorst-Darnell complex. Stones and boulders are on the surface.

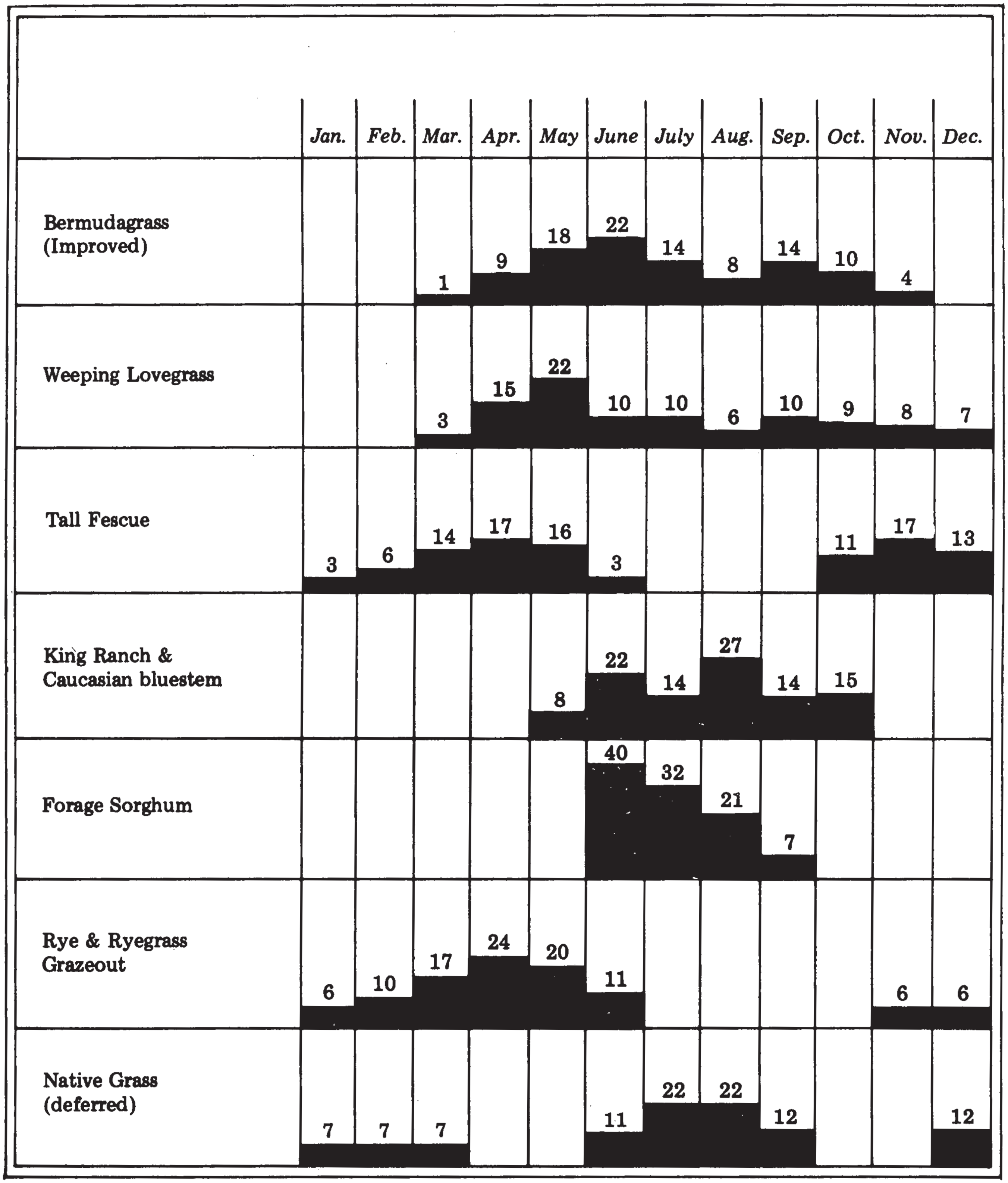

Figure 9.—Forage calendar showing percentage of use.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

Month	Temperature[1]						Precipitation[1]				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[2]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	F	F	F	F	F	Units	In	In	In		In
January-----	54.6	31.8	43.2	79	6	34	1.31	.25	2.12	3	1.7
February----	60.1	35.7	47.9	83	13	75	1.55	.69	2.24	4	1.4
March-------	67.2	42.6	54.9	91	18	238	2.74	.99	4.14	5	.6
April-------	76.9	53.4	65.2	93	32	456	4.14	1.82	6.02	6	.0
May---------	83.6	61.3	72.5	96	43	698	4.36	1.93	6.34	6	.0
June--------	91.0	69.2	80.1	101	55	903	3.34	.99	5.23	5	.0
July--------	95.9	73.3	84.6	105	61	1,073	2.50	.90	3.78	4	.0
August------	95.7	72.0	83.9	105	61	1,051	2.59	.66	4.11	4	.0
September---	88.5	65.4	77.0	102	48	810	3.98	1.19	6.23	5	.0
October-----	78.7	55.1	66.9	95	36	524	3.60	.62	5.86	4	.0
November----	65.7	43.0	54.4	84	22	175	2.35	.49	3.80	4	.1
December----	57.0	35.1	46.1	79	11	49	1.84	.70	2.75	3	.7
Year------	76.2	53.2	64.7	107	6	6,086	34.30	26.11	41.99	53	4.5

[1]Recorded in the period 1951-74 at Ardmore, Okla.

[2]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature[1] 24 F or lower	28 F or lower	32 F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	March 17	April 1	April 7
2 years in 10 later than--	March 10	March 26	April 1
5 years in 10 later than--	February 25	March 14	March 22
First freezing temperature in fall:			
1 year in 10 earlier than--	November 15	November 5	October 28
2 years in 10 earlier than--	November 23	November 13	November 2
5 years in 10 earlier than--	December 8	November 28	November 13

[1]Recorded in the period 1951-74 at Ardmore, Okla.

TABLE 3.--GROWING SEASON LENGTH

Probability	Daily minimum temperature during growing season[1] Higher than 24 F	Higher than 28 F	Higher than 32 F
	Days	Days	Days
9 years in 10	260	228	212
8 years in 10	269	239	220
5 years in 10	286	259	236
2 years in 10	303	279	252
1 year in 10	312	290	260

[1]Recorded in the period 1951-74 at Ardmore, Okla.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Bergstrom silt loam	5,504	1.0
2	Bergstrom silty clay loam	2,714	0.5
3	Bunyan loam	7,960	1.5
4	Burleson clay, 0 to 1 percent slopes	1,702	0.3
5	Chickasha loam, 1 to 3 percent slopes	7,500	1.4
6	Chickasha loam, 3 to 5 percent slopes	1,869	0.3
7	Chickasha loam, 2 to 5 percent slopes, eroded	5,762	1.1
8	Chigley-Darnell Variant complex, 10 to 30 percent slopes	2,157	0.4
9	Clarita silty clay, 3 to 5 percent slopes	4,656	0.9
10	Dale silt loam	3,224	0.6
11	Durant loam, 1 to 3 percent slopes	9,084	1.7
12	Durant loam, 3 to 5 percent slopes	1,723	0.3
13	Elandco clay loam	5,785	1.1
14	Eufaula fine sand, 5 to 15 percent slopes	1,372	0.3
15	Healdton silt loam	3,286	0.6
16	Heiden clay, 1 to 3 percent slopes	5,183	1.0
17	Heiden clay, 5 to 12 percent slopes	9,667	1.8
18	Kemp and Tullahassee soils	3,521	0.7
19	Kiti-Grainola complex, 5 to 20 percent slopes	8,571	1.6
20	Kiti-Rock outcrop complex, 5 to 30 percent slopes	23,234	4.3
21	Konawa fine sandy loam, 0 to 1 percent slopes	3,447	0.6
22	Konawa fine sandy loam, 1 to 3 percent slopes	2,022	0.4
23	Konawa fine sandy loam, 8 to 20 percent slopes	1,239	0.2
24	Konsil loamy fine sand, 0 to 3 percent slopes	16,236	3.0
25	Konsil loamy fine sand, 3 to 8 percent slopes	24,952	4.7
26	Konsil and Weatherford soils, gullied	37,947	7.1
27	Lawton Variant clay loam, 3 to 5 percent slopes	931	0.2
28	Miller silty clay	939	0.2
29	Miller soils	1,904	0.4
30	Normangee loam, 2 to 5 percent slopes	3,362	0.6
31	Normangee loam, 2 to 5 percent slopes, eroded	25,112	4.7
32	Normangee clay loam, 2 to 5 percent slopes, severely eroded	814	0.2
33	Oil-waste land	467	0.1
34	Pits	368	0.1
35	Pulaski fine sandy loam	6,216	1.2
36	Pulaski and Bunyan soils	31,554	5.8
37	Renfrow silt loam, 1 to 3 percent slopes	7,653	1.4
38	Renfrow silt loam, 3 to 5 percent slopes	2,315	0.4
39	Scullin-Kiti complex, 1 to 8 percent slopes	1,704	0.3
40	Steedman clay loam, 5 to 20 percent slopes	12,074	2.3
41	Stephenville-Darnell complex, 2 to 8 percent slopes	7,128	1.3
42	Tamford-Grainola complex, 5 to 12 percent slopes	12,211	2.3
43	Watonga silty clay	4,340	0.8
44	Weatherford fine sandy loam, 1 to 3 percent slopes	18,169	3.4
45	Weatherford fine sandy loam, 3 to 5 percent slopes	10,700	2.0
46	Weatherford fine sandy loam, 2 to 5 percent slopes, eroded	8,663	1.6
47	Weatherford-Duffau complex, 3 to 8 percent slopes	18,699	3.5
48	Weswood silt loam	1,222	0.2
49	Wilson silt loam, 0 to 1 percent slopes	8,538	1.6
50	Wilson silt loam, 1 to 3 percent slopes	4,042	0.8
51	Windthorst fine sandy loam, 1 to 3 percent slopes	9,610	1.8
52	Windthorst fine sandy loam, 3 to 5 percent slopes	14,742	2.8
53	Windthorst fine sandy loam, 2 to 5 percent slopes, eroded	23,214	4.3
54	Windthorst-Darnell complex, 5 to 20 percent slopes	9,638	1.8
55	Windthorst-Weatherford complex, 5 to 12 percent slopes	79,178	14.7
56	Woodford silt loam, 5 to 20 percent slopes	2,108	0.4
57	Yahola soils	1,616	0.3
58	Zaneis loam, 3 to 5 percent slopes	1,844	0.3
	Water	4,288	0.8
	Total	535,680	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[All yields were estimated for a high level of management in 1975. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Grain sorghum	Peanuts	Winter wheat	Alfalfa hay	Improved bermuda-grass	Weeping lovegrass	King Ranch and caucasian bluestem
	Bu	Lb	Bu	Ton	AUM*	AUM	AUM
1, 2 Bergstrom	70	---	45	4.0	7.5	7.5	---
3 Bunyan	65	1,600	35	3.5	8.0	---	---
4 Burleson	70	---	30	2.5	5.5	---	4.0
5 Chickasha	40	1,200	25	---	6.5	7.0	4.0
6 Chickasha	35	1,000	20	---	6.0	6.5	3.5
7 Chickasha	---	---	15	---	5.0	5.5	---
8 Chigley	---	---	---	---	---	---	---
9 Clarita	50	---	26	---	5.0	---	3.5
10** Dale	50	1,700	35	3.5	7.5	7.5	---
11 Durant	50	1,000	35	---	6.0	6.5	4.0
12 Durant	45	---	30	---	5.5	6.0	3.5
13 Elandco	70	---	45	4.0	6.5	---	---
14 Eufaula	---	---	---	---	3.5	5.5	---
15 Healdton	---	---	15	---	3.5	---	---
16 Heiden	68	---	35	2.2	5.5	---	4.0
17 Heiden	---	---	---	---	4.0	---	3.0
18 Kemp	---	---	---	---	8.0	---	---
19 Kiti	---	---	---	---	---	---	---
20 Kiti	---	---	---	---	---	---	---
21 Konawa	50	1,700	30	3.0	7.0	8.0	---
22 Konawa	50	1,500	30	---	7.0	8.0	---

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Grain sorghum	Peanuts	Winter wheat	Alfalfa hay	Improved bermuda-grass	Weeping lovegrass	King Ranch and caucasian bluestem
	Bu	Lb	Bu	Ton	AUM*	AUM	AUM
23----- Konawa	---	---	---	---	4.0	6.5	---
24----- Konsil	40	1,300	25	---	6.0	7.5	---
25----- Konsil	30	800	15	---	5.5	7.0	---
26----- Konsil	---	---	---	---	5.0	5.0	---
27----- Lawton Variant	25	---	20	---	4.5	5.0	3.5
28----- Miller	65	---	35	3.0	6.0	---	---
29----- Miller	---	---	---	---	6.0	---	---
30----- Normangee	45	---	24	---	4.5	4.5	3.0
31----- Normangee	35	---	20	---	4.0	---	2.5
32----- Normangee	---	---	---	---	3.0	---	2.0
33***----- Oil-waste land	---	---	---	---	---	---	---
34***----- Pits	---	---	---	---	---	---	---
35----- Pulaski	60	1,600	30	3.5	8.0	---	---
36----- Pulaski	---	---	---	---	8.0	---	---
37----- Renfrow	30	---	25	---	4.5	5.0	3.5
38----- Renfrow	---	---	20	---	4.0	4.5	3.0
39----- Scullin	---	---	---	---	4.5	---	3.5
40----- Steedman	---	---	---	---	4.0	---	3.0
41----- Stephenville	---	---	---	---	5.0	6.0	---
42----- Tamford	---	---	---	---	4.0	---	3.0
43----- Watonga	50	---	30	2.5	5.0	---	---
44----- Weatherford	40	1,200	25	---	6.5	7.5	---
45, 46----- Weatherford	40	1,000	20	---	6.5	7.5	---

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Grain sorghum	Peanuts	Winter wheat	Alfalfa hay	Improved bermuda-grass	Weeping lovegrass	King Ranch and caucasian bluestem
	Bu	Lb	Bu	Ton	AUM*	AUM	AUM
47-----Weatherford	---	---	15	---	5.0	6.0	---
48-----Weswood	65	1,500	45	4.5	8.0	7.5	---
49-----Wilson	45	---	25	---	5.0	4.5	3.5
50-----Wilson	45	---	25	---	5.0	4.5	3.5
51-----Windthorst	45	1,100	25	---	5.5	7.5	---
52-----Windthorst	35	1,000	20	---	5.0	7.0	---
53-----Windthorst	30	800	15	---	4.0	5.0	---
54-----Windthorst	---	---	---	---	---	---	---
55-----Windthorst	---	---	---	---	4.5	5.5	---
56-----Woodford	---	---	---	---	---	---	---
57-----Yahola	---	---	---	---	8.0	---	---
58-----Zaneis	40	1,000	25	---	6.0	6.5	3.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for a period of 30 days.

** Yields are for areas protected from flooding.

*** See mapping unit description for the composition and behavior of the mapping unit.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Soils not listed do not support rangeland vegetation suited to grazing

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
1, 2 Bergstrom	Loamy Bottomland	Favorable	7,500	Virginia wildrye	15
		Normal	6,000	Beaked panicum	8
		Unfavorable	4,000	Rustyseed paspalum	7
				Switchgrass	15
				Indiangrass	5
				Little bluestem	5
				White tridens	5
				Eastern gamagrass	5
3 Bunyan	Loamy Bottomland	Favorable	6,500	Indiangrass	20
		Normal	5,000	Switchgrass	15
		Unfavorable	3,500	Big bluestem	10
				Little bluestem	10
				Tall dropseed	5
				Texas needlegrass	5
				Sideoats grama	5
				Vine-mesquite	5
4 Burleson	Blackclay Prairie	Favorable	7,000	Little bluestem	40
		Normal	5,500	Indiangrass	15
		Unfavorable	4,000	Big bluestem	15
				Sideoats grama	5
				Texas needlegrass	5
				Silver bluestem	5
				Tall dropseed	5
5, 6 Chickasha	Loamy Prairie	Favorable	5,500	Little bluestem	25
		Normal	3,600	Big bluestem	20
		Unfavorable	2,500	Indiangrass	10
				Switchgrass	10
				Canada spikesedge	5
				Sideoats grama	5
				Blue grama	5
				Tall dropseed	5
7 Chickasha	Loamy Prairie	Favorable	5,500	Little bluestem	25
		Normal	3,600	Big bluestem	20
		Unfavorable	2,500	Indiangrass	10
				Switchgrass	10
				Canada spikesedge	5
				Sideoats grama	5
				Blue grama	5
				Tall dropseed	5
8*:					
Chigley	Sandy Savannah	Favorable	5,000	Little bluestem	30
		Normal	3,000	Big bluestem	10
		Unfavorable	2,500	Indiangrass	10
Darnell Variant	Shallow Savannah	Favorable	3,200	Little bluestem	30
		Normal	2,100	Big bluestem	20
		Unfavorable	1,400	Indiangrass	10
9 Clarita	Blackclay Prairie	Favorable	6,500	Little bluestem	25
		Normal	4,500	Big bluestem	15
		Unfavorable	3,500	Indiangrass	15
				Switchgrass	10
				Eastern gamagrass	5
				Sideoats grama	5
				Tall dropseed	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
10 Dale	Loamy Bottomland	Favorable	8,500	Big bluestem	25
		Normal	6,100	Indiangrass	15
		Unfavorable	4,500	Switchgrass	15
				Little bluestem	10
				Eastern gamagrass	5
				Tall dropseed	5
				Beaked panicum	5
				Compassplant	5
				Heath aster	5
				Sedge	5
11, 12 Durant	Loamy Prairie	Favorable	6,500	Little bluestem	25
		Normal	4,550	Big bluestem	20
		Unfavorable	3,250	Indiangrass	10
				Switchgrass	10
				Canada wildrye	5
				Sideoats grama	5
				Blue grama	5
				Tall dropseed	5
				Lespedeza	5
				Dotted gayfeather	5
13 Elandco	Loamy Bottomland	Favorable	7,500	Indiangrass	20
		Normal	6,000	Switchgrass	15
		Unfavorable	4,000	Little bluestem	10
				Big bluestem	10
				Sideoats grama	5
				Vine-mesquite	5
				Texas needlegrass	5
				Tall dropseed	5
14 Eufaula	Deep Sand Savannah	Favorable	4,000	Little bluestem	25
		Normal	2,800	Big bluestem	10
		Unfavorable	2,000	Sand bluestem	10
				Indiangrass	5
				Switchgrass	5
				Purpletop	5
				Arrowfeather threeawn	5
				Scribner panicum	5
				Sideoats grama	5
				Lespedeza	5
15 Healdton	Alkali Bottomland	Favorable	3,800	Alkali sacaton	22
		Normal	2,700	Switchgrass	15
		Unfavorable	2,000	Western wheatgrass	10
				Blue grama	10
				Inland saltgrass	5
				White tridens	5
				Whorled dropseed	5
16, 17 Heiden	Blackclay Prairie	Favorable	6,000	Little bluestem	50
		Normal	5,000	Big bluestem	15
		Unfavorable	3,500	Indiangrass	10
18*:					
Kemp	Subirrigated	Favorable	6,500	Beaked panicum	20
		Normal	5,000	Sedge	10
		Unfavorable	3,000	Virginia wildrye	10
				Purpletop	10
				Longleaf uniola	10
				Broomsedge bluestem	10
				Indiangrass	5
				Eastern gamagrass	5
				Panicum	5
				Paspalum	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
18*:					
Tullahassee	Subirrigated	Favorable	8,000	Switchgrass	15
		Normal	6,000	Indiangrass	15
		Unfavorable	4,500	Eastern gamagrass	10
				Wildrye	10
				Panicum	10
				Big bluestem	5
19*:					
Kiti	Edgerock	Favorable	2,800	Little bluestem	20
		Normal	2,000	Sideoats grama	20
		Unfavorable	1,400	Big bluestem	10
				Indiangrass	10
				Tridens	10
				Hairy grama	5
Grainola	Shallow Prairie	Favorable	4,000	Little bluestem	30
		Normal	2,800	Big bluestem	15
		Unfavorable	2,000	Indiangrass	10
				Switchgrass	10
				Tall dropseed	5
				Scribner panicum	5
				Sideoats grama	5
				Prairie-clover	5
20*:					
Kiti	Edgerock	Favorable	2,800	Little bluestem	20
		Normal	2,000	Sideoats grama	20
		Unfavorable	1,400	Big bluestem	10
				Indiangrass	10
				Tridens	10
				Hairy grama	5
Rock outcrop.					
21, 22 Konawa	Sandy Savannah	Favorable	4,500	Little bluestem	20
		Normal	3,800	Big bluestem	20
		Unfavorable	2,500	Indiangrass	15
				Switchgrass	10
				Purpletop	5
				Scribner panicum	5
23 Konawa	Sandy Savannah	Favorable	2,500	Little bluestem	30
		Normal	1,600	Indiangrass	10
		Unfavorable	1,250	Splitbeard bluestem	10
				Big bluestem	5
				Switchgrass	5
				Purpletop	5
				Purple lovegrass	5
				Carolina jointtail	5
24, 25 Konsil	Deep Sand Savannah	Favorable	6,500	Little bluestem	45
		Normal	5,000	Indiangrass	10
		Unfavorable	3,500	Big bluestem	10
				Post oak	10
				Purpletop	5
				Sand lovegrass	5
				Blackjack oak	5
26*:					
Konsil	Eroded Sandy Savannah	Favorable	3,500	Little bluestem	45
		Normal	2,700	Indiangrass	10
		Unfavorable	1,500	Big bluestem	10
				Post oak	10
				Purpletop	5
				Sand lovegrass	5
				Blackjack oak	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
26*:					
Weatherford	Eroded Sandy Savannah	Favorable	3,000	Little bluestem	30
		Normal	2,200	Big bluestem	10
		Unfavorable	1,500	Indiangrass	10
				Sideoats grama	5
				Silver bluestem	5
				Scribner panicum	5
				Texas needlegrass	5
				Arizona cottontop	5
27 Lawton Variant	Loamy Prairie	Favorable	5,500	Little bluestem	25
		Normal	3,700	Big bluestem	20
		Unfavorable	2,500	Indiangrass	10
				Switchgrass	10
				Canada wildrye	5
				Sideoats grama	5
				Blue grama	5
				Tall dropseed	5
				Lespedeza	5
				Dotted gayfeather	5
28, 29* Miller	Heavy Bottomland	Favorable	5,000	Big bluestem	25
		Normal	3,200	Switchgrass	15
		Unfavorable	2,000	Indiangrass	15
				Prairie cordgrass	10
				Western wheatgrass	5
				Tall dropseed	5
				Sunflower	5
				Goldenrod	5
				Sedge	5
30, 31 Normangee	Claypan Prairie	Favorable	5,500	Little bluestem	45
		Normal	4,000	Indiangrass	15
		Unfavorable	3,000	Big bluestem	10
				Switchgrass	10
				Florida paspalum	5
				Sideoats grama	5
32 Normangee	Eroded Prairie	Favorable	2,600	Little bluestem	45
		Normal	1,600	Indiangrass	15
		Unfavorable	1,300	Big bluestem	10
				Switchgrass	10
				Florida paspalum	5
				Sideoats grama	5
35 Pulaski	Loamy Bottomland	Favorable	8,500	Big bluestem	25
		Normal	6,100	Indiangrass	15
		Unfavorable	4,500	Switchgrass	15
				Little bluestem	10
				Eastern gamagrass	5
				Tall dropseed	5
				Beaked panicum	5
				Compassplant	5
				Sedge	5
				Heath aster	5
36*:					
Pulaski	Loamy Bottomland	Favorable	8,500	Big bluestem	25
		Normal	6,100	Indiangrass	15
		Unfavorable	4,500	Switchgrass	15
				Little bluestem	10
				Eastern gamagrass	5
				Tall dropseed	5
				Beaked panicum	5
				Compassplant	5
				Sedge	5
				Heath aster	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
36*:					
Bunyan	Loamy Bottomland	Favorable	6,500	Indiangrass	20
		Normal	5,000	Switchgrass	15
		Unfavorable	3,500	Big bluestem	10
				Little bluestem	10
				Tall dropseed	5
				Texas needlegrass	5
				Sideoats grama	5
				Vine-mesquite	5
37, 38 Renfrow	Claypan Prairie	Favorable	4,000	Little bluestem	25
		Normal	2,800	Big bluestem	20
		Unfavorable	2,000	Switchgrass	15
				Indiangrass	10
				Sideoats grama	5
				Blue grama	5
				Buffalograss	5
				Leadplant	5
				Goldenrod	5
				Indiancurrant coralberry	5
39*:					
Scullin	Loamy Prairie	Favorable	6,500	Big bluestem	30
		Normal	4,800	Little bluestem	20
		Unfavorable	3,250	Indiangrass	10
				Switchgrass	10
				Sideoats grama	5
				Purpletop	5
Kiti	Edgerock	Favorable	2,800	Little bluestem	20
		Normal	2,000	Sideoats grama	20
		Unfavorable	1,400	Big bluestem	10
				Indiangrass	10
				Tridens	10
				Hairy grama	5
40 Steedman	Loamy Prairie	Favorable	5,500	Little bluestem	25
		Normal	4,500	Big bluestem	20
		Unfavorable	3,000	Indiangrass	10
				Switchgrass	10
				Canada wildrye	5
				Sideoats grama	5
				Blue grama	5
				Tall dropseed	5
				Lespedeza	5
				Dotted gayfeather	5
41*:					
Stephenville	Sandy Savannah	Favorable	4,500	Little bluestem	25
		Normal	3,300	Big bluestem	20
		Unfavorable	2,500	Indiangrass	5
				Switchgrass	5
				Sand lovegrass	5
				Scribner panicum	5
				Purpletop	5
				Sunflower	5
				Goldenrod	5
Darnell	Shallow Savannah	Favorable	3,200	Little bluestem	30
		Normal	2,100	Big bluestem	20
		Unfavorable	1,400	Indiangrass	5
				Switchgrass	5
				Sideoats grama	5
				Purpletop	5
				Scribner panicum	5
				Tall dropseed	5
				Hairy sunflower	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
42*:					
Tamford	Redclay Prairie	Favorable	3,200	Little bluestem	25
		Normal	2,100	Sideoats grama	15
		Unfavorable	1,400	Big bluestem	10
				Indiangrass	5
				Switchgrass	5
				Blue grama	5
				Buffalograss	5
				Longspike tridens	5
Grainola	Shallow Prairie	Favorable	2,800	Little bluestem	30
		Normal	2,000	Big bluestem	15
		Unfavorable	1,400	Indiangrass	10
				Switchgrass	10
				Tall dropseed	5
				Scribner panicum	5
				Sideoats grama	5
				Prairie-clover	5
43 Watonga	Heavy Bottomland	Favorable	5,500	Big bluestem	25
		Normal	4,000	Switchgrass	15
		Unfavorable	2,500	Indiangrass	15
				Prairie cordgrass	10
				Western wheatgrass	5
				Tall dropseed	5
				Sunflower	5
				Goldenrod	5
				Sedge	5
44, 45, 46 Weatherford	Sandy Savannah	Favorable	5,500	Little bluestem	30
		Normal	4,500	Big bluestem	10
		Unfavorable	3,000	Indiangrass	10
				Sideoats grama	5
				Silver bluestem	5
				Scribner panicum	5
				Texas needlegrass	5
				Arizona cottontop	5
47*:					
Weatherford	Sandy Savannah	Favorable	5,500	Little bluestem	30
		Normal	4,500	Big bluestem	10
		Unfavorable	3,000	Indiangrass	10
				Sideoats grama	5
				Silver bluestem	5
				Scribner panicum	5
				Texas needlegrass	5
				Arizona cottontop	5
Duffau	Sandy Savannah	Favorable	5,500	Little bluestem	30
		Normal	4,500	Big bluestem	10
		Unfavorable	3,000	Indiangrass	10
				Sideoats grama	5
				Silver bluestem	5
				Scribner panicum	5
				Texas needlegrass	5
				Arizona cottontop	5
48 Weswood	Loamy Bottomland	Favorable	7,000	Indiangrass	20
		Normal	5,500	Switchgrass	15
		Unfavorable	4,000	Big bluestem	10
				Little bluestem	10
				Canada wildrye	5
				Texas needlegrass	5
				Sideoats grama	5
				Vine-mesquite	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
49, 50 Wilson	Claypan Prairie	Favorable	4,800	Little bluestem	45
		Normal	3,200	Indiangrass	10
		Unfavorable	2,200	Big bluestem	10
				Virginia wildrye	5
				Vine-mesquite	5
				Florida paspalum	5
				Sideoats grama	5
				Texas needlegrass	5
				Silver bluestem	5
51, 52, 53 Windthorst	Sandy Savannah	Favorable	4,500	Little bluestem	30
		Normal	3,200	Big bluestem	10
		Unfavorable	2,000	Indiangrass	10
				Sideoats grama	5
				Silver bluestem	5
				Scribner panicum	5
				Texas needlegrass	5
				Arizona cottontop	5
54*:					
Windthorst	Sandy Savannah	Favorable	4,500	Little bluestem	30
		Normal	3,200	Big bluestem	10
		Unfavorable	2,000	Indiangrass	10
				Sideoats grama	5
				Silver bluestem	5
				Scribner panicum	5
				Texas needlegrass	5
				Arizona cottontop	5
Darnell	Shallow Savannah	Favorable	3,200	Little bluestem	30
		Normal	2,100	Big bluestem	20
		Unfavorable	1,400	Indiangrass	5
				Switchgrass	5
				Sideoats grama	5
				Purpletop	5
				Scribner panicum	5
				Tall dropseed	5
				Hairy sunflower	5
55*:					
Windthorst	Sandy Savannah	Favorable	4,500	Little bluestem	30
		Normal	3,200	Big bluestem	10
		Unfavorable	2,000	Indiangrass	10
				Sideoats grama	5
				Silver bluestem	5
				Scribner panicum	5
				Texas needlegrass	5
				Arizona cottontop	5
Weatherford	Sandy Savannah	Favorable	5,500	Little bluestem	30
		Normal	4,500	Big bluestem	10
		Unfavorable	3,000	Indiangrass	10
				Sideoats grama	5
				Silver bluestem	5
				Scribner panicum	5
				Texas needlegrass	5
				Arizona cottontop	5
56 Woodford	Very Shallow	Favorable	2,000	Sideoats grama	20
		Normal	1,100	Hairy grama	20
		Unfavorable	500	Little bluestem	10
				Tridens	10

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Compo- sition
		Kind of year	Dry weight		
			Lb/acre		Pct
57*: Yahola	Loamy Bottomland	Favorable	7,000	Big bluestem	25
		Normal	4,900	Indiangrass	15
		Unfavorable	3,500	Switchgrass	15
				Little bluestem	10
				Eastern gamagrass	5
				Tall dropseed	5
				Beaked panicum	5
				Compassplant	5
				Sedge	5
				Heath aster	5
58: Zaneis	Loamy Prairie	Favorable	5,500	Little bluestem	25
		Normal	3,600	Big bluestem	20
		Unfavorable	2,500	Indiangrass	15
				Switchgrass	10

* See mapping unit description for the composition and behavior of the mapping unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[Absence of an entry means the species does not grow well on the soil]

Soil name and map symbol	Expected heights of specified trees at 20 years of age							
	Eastern redcedar	Green ash	Eastern cottonwood	Loblolly pine	Osage-orange	Shortleaf pine	Austrian pine	American plum
	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft
1, 2 Bergstrom	25	35	60	---	30	35	---	10
3 Bunyan	35	50	75	45	20	30	35	12
4 Burleson	25	---	---	---	25	---	---	---
5, 6, 7 Chickasha	20	---	---	20	---	20	20	8
8*:								
Chigley	20	---	---	---	---	25	20	---
Darnell Variant	---	---	---	---	---	---	---	---
9 Clarita	25	---	---	---	25	---	---	---
10 Dale	35	55	---	---	---	40	35	---
11, 12 Durant	20	---	---	---	20	---	---	---
13 Elandco	25	35	60	---	30	---	---	10
14 Eufaula	15	---	---	---	---	---	20	12
15 Healdton	---	---	---	---	---	---	---	---
16, 17 Heiden	15	---	---	---	15	---	---	---
18*:								
Kemp	25	50	75	---	25	---	---	---
Tullahassee	25	55	70	30	25	---	---	---
19*:								
Kiti	---	---	---	---	---	---	---	---
Grainola	15	---	---	---	---	---	---	---
20*:								
Kiti	---	---	---	---	---	---	---	---
Rock outcrop	---	---	---	---	---	---	---	---
21, 22, 23 Konawa	20	---	---	25	20	25	20	8
24, 25 Konsil	20	---	---	25	18	---	20	8
26*:								
Konsil	20	---	---	25	18	---	20	8
Weatherford	20	---	---	25	18	---	20	8

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Expected heights of specified trees at 20 years of age							
	Eastern redcedar	Green ash	Eastern cottonwood	Loblolly pine	Osage-orange	Shortleaf pine	Austrian pine	American plum
	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft
27----- Lawton Variant	20	---	---	---	20	---	---	---
28, 29*----- Miller	25	40	60	---	25	40	---	---
30, 31, 32----- Normangee	15	---	---	---	18	---	---	---
33*----- Oil-waste land	---	---	---	---	---	---	---	---
34*----- Pits	---	---	---	---	---	---	---	---
35----- Pulaski	25	30	60	40	20	35	30	---
36*:								
Pulaski-----	---	30	60	40	---	35	30	---
Bunyan-----	---	50	75	45	20	---	35	---
37, 38----- Renfrow	15	---	---	---	15	---	---	---
39*:								
Scullin-----	15	---	---	---	15	---	---	---
Kiti-----	---	---	---	---	---	---	---	---
40----- Steedman	25	---	---	---	25	---	---	---
41*:								
Stephenville-----	25	---	---	25	15	---	20	8
Darnell-----	18	---	---	---	---	---	---	---
42*:								
Tamford-----	20	---	---	---	15	---	---	---
Grainola-----	---	---	---	---	---	---	---	---
43----- Watonga	20	---	---	---	25	---	---	---
44, 45, 46----- Weatherford	25	---	---	25	20	---	20	8
47*:								
Weatherford-----	25	---	---	25	20	---	20	8
Duffau-----	25	---	---	25	20	---	20	8
48----- Weswood	25	50	70	35	20	---	30	10
49, 50----- Wilson	---	---	---	---	15	---	---	---
51, 52, 53----- Windthorst	15	---	---	---	15	---	---	---
54*:								
Windthorst-----	15	---	---	---	---	---	---	---
Darnell-----	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Expected heights of specified trees at 20 years of age							
	Eastern redcedar	Green ash	Eastern cottonwood	Loblolly pine	Osage-orange	Shortleaf pine	Austrian pine	American plum
	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft
55*:								
Windthorst	15	---	---	---	15	---	---	---
Weatherford	25	---	---	25	20	---	20	8
56 Woodford	---	---	---	---	---	---	---	---
57* Yahola	30	---	60	40	---	35	30	---
58 Zaneis	25	---	---	---	20	---	---	---

* See mapping unit description for the composition and behavior of the mapping unit.

TABLE 8.--BUILDING SITE DEVELOPMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1, 2 Bergstrom	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
3 Bunyan	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
4 Burleson	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, corrosive.	Severe: shrink-swell.
5 Chickasha	Slight	Slight	Slight	Slight	Moderate: low strength.
6 Chickasha	Slight	Slight	Slight	Moderate	Moderate: low strength.
7 Chickasha	Slight	Slight	Slight	Slight	Moderate: low strength.
8*:					
Chigley	Severe: too clayey.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.
Darnell Variant	Severe: slope, small stones.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
9 Clarita	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
10 Dale	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: low strength, shrink-swell, floods.
11, 12 Durant	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
13 Elandco	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength.
14 Eufaula	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
15 Healdton	Severe: floods, wetness, too clayey.	Severe: floods, low strength, shrink-swell.	Severe: floods, low strength, shrink-swell.	Severe: floods, low strength, shrink-swell.	Severe: low strength, shrink-swell.
16, 17 Heiden	Severe: cutbanks cave, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
18*:					
Kemp	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Tullahassee	Severe: wetness, floods.	Severe: floods.	Severe: wetness, floods.	Severe: floods.	Severe: floods.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
19*:					
Kiti	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, slope.
Grainola	Severe: too clayey, slope.	Severe: slope, shrink-swell, low strength.	Severe: low strength, slope, shrink-swell.	Severe: low strength, slope, shrink-swell.	Severe: low strength, slope, shrink-swell.
20*:					
Kiti	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.
Rock outcrop.					
21, 22 Konawa	Slight	Slight	Slight	Slight	Moderate: low strength.
23 Konawa	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
24, 25 Konsil	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength.
26*:					
Konsil	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength.
Weatherford	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
27 Lawton Variant	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
28, 29* Miller	Severe: floods, too clayey.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: low strength, shrink-swell.
30, 31, 32 Normangee	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, corrosive.	Severe: shrink-swell, low strength.
33*. Oil-waste land.					
34*. Pits.					
35 Pulaski	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.
36*:					
Pulaski	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Bunyan	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
37, 38 Renfrow	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
39*:					
Scullin	Severe: depth to rock.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, depth to rock.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
Kiti	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
40 Steedman	Severe: wetness, too clayey.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: shrink-swell, low strength, slope.	Severe: low strength, shrink-swell.
41*:					
Stephenville	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope, low strength.
Darnell	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: depth to rock, slope, low strength.
42*:					
Tamford	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, slope, shrink-swell.	Severe: low strength, shrink-swell.
Grainola	Severe: too clayey, slope.	Severe: slope, shrink-swell, low strength.	Severe: low strength, slope, shrink-swell.	Severe: low strength, slope, shrink-swell.	Severe: low strength, slope, shrink-swell.
43 Watonga	Severe: too clayey.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: shrink-swell, low strength.
44 Weatherford	Slight	Slight	Slight	Slight	Moderate: low strength.
45 Weatherford	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
46 Weatherford	Slight	Slight	Slight	Slight	Moderate: low strength.
47*:					
Weatherford	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
Duffau	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
48 Weswood	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: low strength.
49, 50 Wilson	Severe: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
51 Windthorst	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
52----------------- Windthorst	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
53----------------- Windthorst	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
54*:					
Windthorst--------	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Darnell-----------	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: slope.
55*:					
Windthorst--------	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Weatherford-------	Slight-----------	Slight-----------	Slight-----------	Moderate: slope.	Moderate: low strength.
56----------------- Woodford	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.
57*---------------- Yahola	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
58----------------- Zaneis	Slight-----------	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength, slope.	Moderate: shrink-swell, low strength.

* See mapping unit description for the composition and behavior of the mapping unit.

TABLE 9.--SANITARY FACILITIES

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1------------------ Bergstrom	Severe: floods.	Severe: seepage, floods.	Severe: floods.	Severe: floods.	Good.
2------------------ Bergstrom	Severe: floods.	Severe: seepage, floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
3------------------ Bunyan	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
4------------------ Burleson	Severe: percs slowly.	Slight------------	Severe: too clayey.	Slight------------	Poor: too clayey.
5, 6, 7------------ Chickasha	Moderate: depth to rock.	Moderate: seepage, depth to rock.	Moderate: depth to rock.	Slight------------	Good.
8*:					
Chigley------------	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey, depth to rock.	Moderate: wetness.	Poor: hard to pack, too clayey.
Darnell Variant----	Severe: depth to rock, slope.	Severe: depth to rock, slope, small stones.	Severe: slope, depth to rock.	Severe: slope.	Poor: thin layer, slope, small stones.
9------------------ Clarita	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight------------	Poor: too clayey.
10----------------- Dale	Moderate: floods.	Moderate: seepage.	Moderate: floods.	Moderate: floods.	Good.
11, 12------------- Durant	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight------------	Poor: too clayey.
13----------------- Elandco	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
14----------------- Eufaula	Moderate: slope.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
15----------------- Healdton	Severe: percs slowly, floods.	Severe: floods.	Severe: floods, too clayey.	Severe: floods.	Poor: too clayey, area reclaim.
16----------------- Heiden	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight------------	Poor: too clayey.
17----------------- Heiden	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
18*:					
Kemp---------------	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Tullahassee--------	Severe: floods, wetness.	Severe: wetness, floods, seepage.	Severe: floods, wetness, seepage.	Severe: wetness, floods, seepage.	Good.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
19*:					
Kiti	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, small stones.
Grainola	Severe: percs slowly, slope, depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: slope.	Poor: too clayey, slope.
20*:					
Kiti	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: slope.	Poor: thin layer, small stones.
Rock outcrop.					
21, 22, 23 Konawa	Slight	Severe: seepage.	Severe: seepage.	Slight	Good.
24, 25 Konsil	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Fair: too sandy.
26*:					
Konsil	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Fair: too sandy.
Weatherford	Moderate: depth to rock.	Moderate: slope, seepage.	Moderate: depth to rock.	Slight	Fair: area reclaim.
27 Lawton Variant	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
28, 29* Miller	Severe: percs slowly, floods.	Severe: floods.	Severe: floods, too clayey.	Severe: floods.	Poor: too clayey, hard to pack.
30, 31, 32 Normangee	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
33*. Oil-waste land.					
34*. Pits.					
35 Pulaski	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage.	Severe: floods, seepage.	Good.
36*:					
Pulaski	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage.	Severe: floods, seepage.	Good.
Bunyan	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
37, 38 Renfrow	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: thin layer.
39*:					
Scullin	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Slight	Poor: too clayey.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
39*: Kiti	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, small stones.
40 Steedman	Severe: percs slowly, wetness, depth to rock.	Severe: depth to rock, slope, wetness.	Severe: depth to rock, wetness, too clayey.	Severe: wetness.	Poor: too clayey.
41*: Stephenville	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Moderate: depth to rock.	Moderate: slope.	Fair: thin layer, slope.
Darnell	Severe: depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage.	Severe: seepage, slope.	Poor: thin layer, slope.
42*: Tamford	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: hard to pack, too clayey.
Grainola	Severe: percs slowly, slope, depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: slope.	Poor: too clayey, slope.
43 Watonga	Severe: percs slowly.	Severe: floods.	Severe: too clayey, floods.	Moderate: floods.	Poor: too clayey, hard to pack.
44, 45, 46 Weatherford	Moderate: depth to rock.	Moderate: slope, seepage.	Moderate: depth to rock.	Slight	Fair: area reclaim.
47*: Weatherford	Moderate: depth to rock.	Moderate: slope, seepage.	Moderate: depth to rock.	Slight	Fair: area reclaim.
Duffau	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
48 Weswood	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
49 Wilson	Severe: percs slowly.	Slight	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
50 Wilson	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
51, 52, 53 Windthorst	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
54*: Windthorst	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: too clayey.
Darnell	Severe: depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, large stones.	Severe: seepage, slope.	Poor: thin layer, large stones.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
55*:					
Windthorst	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Weatherford	Moderate: depth to rock.	Severe: slope, seepage.	Moderate: depth to rock.	Slight	Fair: area reclaim.
56 Woodford	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, small stones.	Moderate: slope.	Poor: thin layer, small stones.
57* Yahola	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage.	Severe: floods, seepage.	Good.
58 Zaneis	Severe: percs slowly.	Moderate: depth to rock, slope.	Moderate: too clayey, depth to rock.	Slight	Fair: thin layer.

* See mapping unit description for the composition and behavior of the mapping unit.

TABLE 10.--CONSTRUCTION MATERIALS

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1, 2 Bergstrom	Fair: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
3 Bunyan	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
4 Burleson	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
5, 6, 7 Chickasha	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
8*:				
Chigley	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
Darnell Variant	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones, slope.
9 Clarita	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
10 Dale	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
11, 12 Durant	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
13 Elandco	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
14 Eufaula	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
15 Healdton	Poor: low strength, shrink-swell, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
16, 17 Heiden	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
18*:				
Kemp	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Tullahassee	Fair: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
19*:				
Kiti	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
Grainola	Poor: low strength, shrink-swell, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
20*:				
Kiti------------------	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones, slope.
Rock outcrop.				
21, 22, 23------------ Konawa	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
24, 25---------------- Konsil	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
26*:				
Konsil----------------	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Weatherford-----------	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
27-------------------- Lawton Variant	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, thin layer.
28, 29*--------------- Miller	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
30, 31, 32------------ Normangee	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
33*. Oil-waste land.				
34*. Pits.				
35-------------------- Pulaski	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
36*:				
Pulaski---------------	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
Bunyan----------------	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
37, 38---------------- Renfrow	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
39*:				
Scullin---------------	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
Kiti------------------	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
40-------------------- Steedman	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
41*:				
Stephenville----------	Fair: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
41*:				
Darnell	Fair: low strength, thin layer.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Fair: thin layer, slope.
42*:				
Tamford	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, slope.
Grainola	Poor: low strength, shrink-swell, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
43 Watonga	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
44, 45, 46 Weatherford	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
47*:				
Weatherford	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Duffau	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
48 Weswood	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
49, 50 Wilson	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
51, 52, 53 Windthorst	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
54*:				
Windthorst	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Darnell	Fair: thin layer, large stones.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Poor: large stones.
55*:				
Windthorst	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Weatherford	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
56 Woodford	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
57* Yahola	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
58 Zaneis	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.

* See mapping unit description for the composition and behavior of the mapping unit.

TABLE 11.--WATER MANAGEMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not evaluated]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
1, 2----------------- Bergstrom	Moderate: seepage.	Moderate: compressible, piping.	Severe: deep to water.	Floods----------	Floods----------	Favorable.
3------------------- Bunyan	Moderate: seepage.	Moderate: piping.	Severe: deep to water.	Floods----------	Not needed------	Favorable.
4------------------- Burleson	Slight----------	Moderate: unstable fill, hard to pack.	Severe: deep to water.	Slow intake-----	Percs slowly----	Percs slowly.
5, 6, 7------------- Chickasha	Moderate: depth to rock, seepage.	Moderate: thin layer.	Severe: deep to water.	Erodes easily	Erodes easily	Erodes easily.
8*:						
Chigley-------------	Moderate: depth to rock, seepage.	Moderate: unstable fill, compressible.	Severe: slow refill.	Erodes easily, slow intake.	Erodes easily, percs slowly.	Percs slowly.
Darnell Variant----	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Erodes easily, rooting depth, slope.	Depth to rock, erodes easily, slope.	Not needed.
9------------------- Clarita	Slight----------	Severe: unstable fill, compressible, low strength.	Severe: no water.	Slow intake, erodes easily.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
10------------------ Dale	Moderate: seepage.	Moderate: unstable fill, piping, compressible.	Severe: deep to water.	Favorable-------	Favorable-------	Favorable.
11, 12-------------- Durant	Slight----------	Severe: piping, compressible.	Severe: no water.	Slow intake-----	Percs slowly----	Percs slowly.
13------------------ Elandco	Severe: seepage.	Moderate: piping.	Severe: deep to water.	Floods----------	Not needed------	Favorable.
14------------------ Eufaula	Severe: seepage.	Moderate: unstable fill, piping.	Severe: no water.	Seepage, fast intake, droughty.	Seepage, fast intake, droughty.	Erodes easily, droughty, fast intake.
15------------------ Healdton	Slight----------	Severe: erodes easily, shrink-swell.	Severe: no water.	Excess salt, slow intake.	Erodes easily	Excess salt, percs slowly.
16------------------ Heiden	Slight----------	Moderate: unstable fill, shrink-swell.	Severe: no water.	Slow intake-----	Percs slowly----	Percs slowly.
17------------------ Heiden	Slight----------	Moderate: unstable fill, shrink-swell.	Severe: no water.	Slow intake, slope.	Slope-----------	Percs slowly, slope.
18*:						
Kemp----------------	Moderate: seepage.	Moderate: compressible.	Severe: deep to water.	Floods----------	Floods----------	Favorable.
Tullahassee---------	Severe: seepage.	Moderate: unstable fill, piping.	Moderate: deep to water.	Wetness, floods.	Not needed------	Favorable.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
19*:						
Kiti	Severe: depth to rock.	Severe: thin layer.	Severe: deep to water.	Droughty, rooting depth.	Not needed	Not needed.
Grainola	Slight	Severe: compressible, shrink-swell.	Severe: no water.	Slow intake, slope.	Percs slowly, slope.	Percs slowly, slope.
20*:						
Kiti	Severe: depth to rock.	Severe: thin layer.	Severe: deep to water.	Droughty, rooting depth.	Not needed	Not needed.
Rock outcrop.						
21, 22, 23 Konawa	Severe: seepage.	Moderate: low strength, unstable fill, piping.	Severe: deep to water.	Erodes easily	Erodes easily	Erodes easily.
24, 25 Konsil	Moderate: seepage.	Moderate: piping.	Severe: no water.	Erodes easily	Erodes easily	Favorable.
26*:						
Konsil	Moderate: seepage.	Moderate: piping.	Severe: no water.	Erodes easily	Erodes easily	Favorable.
Weatherford	Moderate: seepage, depth to rock.	Moderate: erodes easily, piping.	Severe: no water.	Erodes easily	Erodes easily	Erodes easily.
27 Lawton Variant	Moderate: seepage.	Moderate: unstable fill, compressible.	Severe: no water.	Slow intake, erodes easily.	Percs slowly	Percs slowly.
28, 29* Miller	Slight	Moderate: unstable fill, compressible.	Severe: deep to water.	Floods, slow intake.	Not needed	Percs slowly.
30, 31, 32 Normangee	Slight	Moderate: unstable fill.	Severe: no water.	Percs slowly, slow intake, erodes easily.	Slow intake, erodes easily, percs slowly.	Percs slowly, erodes easily.
33*. Oil-waste land.						
34*. Pits.						
35 Pulaski	Severe: seepage.	Moderate: unstable fill, seepage, piping.	Severe: deep to water.	Floods	Not needed	Not needed.
36*:						
Pulaski	Severe: seepage.	Moderate: unstable fill, seepage, piping.	Severe: deep to water.	Floods	Not needed	Not needed.
Bunyan	Moderate: seepage.	Moderate: piping.	Severe: deep to water.	Floods	Not needed	Favorable.
37, 38 Renfrow	Slight	Moderate: unstable fill, compressible.	Severe: no water.	Erodes easily, percs slowly.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
39*:						
Scullin	Severe: depth to rock.	Moderate: compressible, unstable fill.	Severe: deep to water.	Rooting depth, slow intake.	Depth to rock, percs slowly.	Percs slowly, rooting depth.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
39*:						
Kiti	Severe: depth to rock.	Severe: thin layer.	Severe: deep to water.	Droughty, rooting depth.	Not needed	Not needed.
40 Steedman	Slight	Severe: compressible, shrink-swell.	Severe: no water.	Slow intake, slope.	Percs slowly	Percs slowly.
41*:						
Stephenville	Severe: depth to rock.	Moderate: thin layer.	Severe: no water.	Slope	Slope	Slope.
Darnell	Severe: depth to rock, seepage.	Severe: thin layer.	Severe: no water.	Slope, rooting depth.	Slope, rooting depth.	Slope.
42*:						
Tamford	Slight	Severe: compressible, piping, shrink-swell.	Severe: no water.	Slow intake	Percs slowly	Percs slowly.
Grainola	Slight	Severe: compressible, shrink-swell.	Severe: no water.	Slow intake, slope.	Percs slowly, slope.	Percs slowly, slope.
43 Watonga	Slight	Moderate: unstable fill, compressible.	Severe: no water.	Slow intake, floods.	Not needed	Favorable.
44, 45, 46 Weatherford	Moderate: seepage, depth to rock.	Moderate: erodes easily, piping.	Severe: no water.	Erodes easily	Erodes easily	Erodes easily.
47*:						
Weatherford	Moderate: seepage, depth to rock.	Moderate: erodes easily, piping.	Severe: no water.	Erodes easily	Erodes easily	Erodes easily.
Duffau	Moderate: seepage.	Moderate: erodes easily, piping.	Severe: no water.	Erodes easily	Erodes easily	Erodes easily.
48 Weswood	Moderate: seepage.	Moderate: piping, erodes easily.	Severe: deep to water.	Floods	Favorable	Favorable.
49, 50 Wilson	Slight	Moderate: unstable fill.	Severe: no water.	Percs slowly, slow intake.	Percs slowly	Percs slowly.
51, 52, 53 Windthorst	Moderate: seepage.	Moderate: compressible.	Severe: no water.	Percs slowly, erodes easily.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
54*:						
Windthorst	Moderate: seepage.	Moderate: compressible.	Severe: no water.	Percs slowly, erodes easily.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Darnell	Severe: depth to rock, seepage.	Severe: thin layer.	Severe: no water.	Slope	Slope	Slope.
55*:						
Windthorst	Moderate: seepage.	Moderate: compressible.	Severe: no water.	Percs slowly, erodes easily.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Weatherford	Moderate: seepage, depth to rock.	Moderate: erodes easily, piping.	Severe: no water.	Erodes easily	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
56----------------- Woodford	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Rooting depth, slope.	Depth to rock	Rooting depth.
57*---------------- Yahola	Severe: seepage.	Moderate: unstable fill, seepage, piping.	Severe: deep to water.	Floods----------	Not needed------	Not needed.
58----------------- Zaneis	Moderate: seepage, depth to rock.	Moderate: thin layer, unstable fill, piping.	Severe: no water.	Erodes easily	Erodes easily, percs slowly.	Erodes easily, percs slowly.

* See mapping unit description for the composition and behavior of the mapping unit.

TABLE 12.--RECREATIONAL DEVELOPMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
1 Bergstrom	Severe: floods.	Severe: floods.	Moderate: floods.	Slight.
2 Bergstrom	Severe: floods.	Severe: floods.	Moderate: floods.	Moderate: too clayey.
3 Bunyan	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
4 Burleson	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
5, 6, 7 Chickasha	Slight	Slight	Moderate: slope.	Slight.
8*:				
Chigley	Severe: percs slowly, slope.	Severe: small stones, slope.	Severe: small stones, slope.	Moderate: slope.
Darnell Variant	Severe: slope.	Severe: slope.	Severe: slope, depth to rock, small stones.	Moderate: slope.
9 Clarita	Severe: percs slowly.	Severe: too clayey.	Severe: percs slowly.	Severe: too clayey.
10 Dale	Slight	Slight	Slight	Slight.
11, 12 Durant	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
13 Elandco	Severe: floods.	Moderate: floods.	Moderate: floods.	Moderate: too clayey.
14 Eufaula	Moderate: too sandy.	Moderate: too sandy.	Severe: too sandy.	Severe: too sandy.
15 Healdton	Severe: floods, percs slowly.	Severe: floods, dusty.	Severe: percs slowly.	Moderate: dusty.
16, 17 Heiden	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
18*:				
Kemp	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
Tullahassee	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: wetness, floods.
19*:				
Kiti	Moderate: small stones.	Moderate: small stones.	Severe: depth to rock, small stones.	Moderate: small stones.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
19*:				
Grainola	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too clayey.
20*:				
Kiti	Severe: slope.	Severe: slope.	Severe: depth to rock, small stones.	Moderate: small stones.
Rock outcrop.				
21, 22 Konawa	Slight	Slight	Slight	Slight.
23 Konawa	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
24 Konsil	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
25 Konsil	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
26*:				
Konsil	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Weatherford	Slight	Slight	Moderate: slope.	Slight.
27 Lawton Variant	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Moderate: percs slowly, too clayey.	Moderate: percs slowly.
28 Miller	Severe: floods, percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly.	Severe: too clayey.
29* Miller	Severe: floods, percs slowly, too clayey.	Severe: floods.	Severe: percs slowly.	Severe: floods.
30, 31, 32 Normangee	Severe: percs slowly.	Moderate: too clayey.	Severe: percs slowly.	Moderate: too clayey.
33*. Oil-waste land.				
34*. Pits.				
35 Pulaski	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
36*:				
Pulaski	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
Bunyan	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
37, 38 Renfrow	Severe: percs slowly.	Slight	Severe: slope, percs slowly.	Slight.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
39*:				
Scullin	Moderate: percs slowly.	Slight	Moderate: percs slowly, slope, depth to rock.	Slight.
Kiti	Moderate: small stones.	Moderate: small stones.	Severe: depth to rock, small stones.	Moderate: small stones.
40 Steedman	Moderate: percs slowly, slope.	Moderate: slope, too clayey.	Severe: slope.	Moderate: too clayey.
41*:				
Stephenville	Slight	Slight	Moderate: slope.	Slight.
Darnell	Slight	Slight	Severe: depth to rock, slope.	Slight.
42*:				
Tamford	Severe: percs slowly.	Moderate: too clayey.	Severe: percs slowly, slope.	Moderate: too clayey.
Grainola	Moderate: percs slowly.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
43 Watonga	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
44 Weatherford	Slight	Slight	Moderate: slope.	Slight.
45, 46 Weatherford	Slight	Slight	Moderate: slope.	Slight.
47*:				
Weatherford	Slight	Slight	Severe: slope.	Slight.
Duffau	Slight	Slight	Severe: slope.	Slight.
48 Weswood	Severe: floods.	Severe: floods.	Moderate: floods.	Slight.
49, 50 Wilson	Severe: percs slowly, wetness.	Moderate: wetness.	Severe: percs slowly, wetness.	Moderate: wetness.
51 Windthorst	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
52, 53 Windthorst	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
54*:				
Windthorst	Severe: percs slowly, slope.	Moderate: slope.	Severe: slope.	Slight.
Darnell	Severe: large stones, slope.	Severe: slope.	Severe: depth to rock, large stones.	Severe: large stones.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
55*:				
Windthorst	Moderate: percs slowly, slope.	Slight	Severe: slope.	Slight.
Weatherford	Slight	Slight	Severe: slope.	Slight.
56 Woodford	Moderate: small stones, slope.	Moderate: small stones, slope.	Severe: depth to rock, slope.	Moderate: small stones.
57* Yahola	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
58 Zaneis	Moderate: percs slowly.	Slight	Moderate: percs slowly, slope.	Slight.

* See mapping unit description for the composition and behavior of the mapping unit.

TABLE 13.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
1, 2 Bergstrom	Good	Good	Fair	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
3 Bunyan	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
4 Burleson	Good	Good	Poor	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
5, 6, 7 Chickasha	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
8*:												
Chigley	Fair	Good	Good	---	---	Fair	Very poor.	Very poor.	Good	---	Very poor.	Fair.
Darnell Variant	Poor	Poor	Poor	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
9 Clarita	Fair	Fair	Poor	---	---	Poor	Poor	Very poor.	Fair	---	Very poor.	Poor.
10 Dale	Good	Good	Fair	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Fair.
11 Durant	Good	Good	Good	---	---	Fair	Poor	Poor	Good	---	Poor	Fair.
12 Durant	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
13 Elandco	Good	Good	Fair	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Fair.
14 Eufaula	Fair	Fair	Fair	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
15 Healdton	Poor	Poor	Very poor.	---	---	Poor	Poor	Poor	Poor	---	Poor	Poor.
16 Heiden	Good	Good	Fair	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
17 Heiden	Poor	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
18*:												
Kemp	Poor	Fair	Fair	---	---	Good	Poor	Very poor.	Fair	---	Very poor.	Fair.
Tullahassee	Very poor.	Poor	Poor	---	---	---	Fair	Poor	Poor	---	Poor	Fair.
19*:												
Kiti	Very poor.	Poor	Poor	---	---	Very poor.	Very poor.	Very poor.	Poor	---	Very poor.	Very poor.
Grainola	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
20*:												
Kiti	Very poor.	Poor	Poor	---	---	Very poor.	Very poor.	Very poor.	Poor	---	Very poor.	Very poor.

See footnotes at end of table.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
20*:												
Rock outcrop------	---	---	---	---	---	---	---	---	---	---	---	---
21, 22-------------- Konawa	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
23------------------ Konawa	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
24, 25-------------- Konsil	Good	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
26*:												
Konsil-------------	Good	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
Weatherford--------	Poor	Fair	Good	---	---	Good	Poor	Very poor.	Fair	---	Very poor.	Good.
27------------------ Lawton Variant	Good	Good	Fair	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
28------------------ Miller	Fair	Fair	Poor	---	---	Poor	Poor	Poor	Fair	---	Poor	Poor.
29*----------------- Miller	Poor	Fair	Poor	---	---	Poor	Poor	Poor	Poor	---	Poor	Poor.
30, 31, 32---------- Normangee	Fair	Good	Fair	---	---	Good	Poor	Poor	Fair	---	Poor	Fair.
33------------------ Oil-waste land	Very poor.	Very poor.	Very poor.	---	---	Very poor.	Very poor.	Very poor.	Poor	---	Very poor.	Very poor.
34. Pits												
35------------------ Pulaski	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
36*:												
Pulaski------------	Poor	Fair	Fair	---	---	Good	Poor	Very poor.	Fair	---	Very poor.	Fair.
Bunyan-------------	Very poor.	Poor	Fair	---	---	Good	Poor	Very poor.	Poor	---	Very poor.	Fair.
37, 38-------------- Renfrow	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
39*:												
Scullin------------	Fair	Good	Good	---	---	Poor	Poor	Very poor.	Fair	---	Very poor.	Fair.
Kiti---------------	Very poor.	Poor	Poor	---	---	Very poor.	Very poor.	Very poor.	Poor	---	Very poor.	Very poor.
40------------------ Steedman	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
41*:												
Stephenville	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
Darnell------------	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.

See footnotes at end of table.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
42*:												
Tamford	Fair	Good	Fair	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
Grainola	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
43 Watonga	Fair	Fair	Poor	---	---	Fair	Poor	Poor	Fair	---	Poor	Fair.
44 Weatherford	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
45, 46 Weatherford	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
47*:												
Weatherford	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
Duffau	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
48 Weswood	Good	Good	Fair	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Fair.
49, 50 Wilson	Fair	Fair	Good	---	---	Fair	Fair	Fair	Fair	---	Fair	Fair.
51 Windthorst	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
52 Windthorst	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
53 Windthorst	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
54*:												
Windthorst	Poor	Fair	Good	---	---	Good	Poor	Very poor.	Fair	---	Very poor.	Good.
Darnell	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
55*:												
Windthorst	Poor	Fair	Good	---	---	Good	Poor	Very poor.	Fair	---	Very poor.	Good.
Weatherford	Poor	Fair	Good	---	---	Good	Poor	Very poor.	Fair	---	Very poor.	Good.
56 Woodford	Very poor.	Poor	Fair	---	---	Very poor.	Poor	Very poor.	Poor	---	Very poor.	Very poor.
57* Yahola	Poor	Fair	Fair	---	---	Good	Poor	Very poor.	Fair	---	Very poor.	Fair.
58 Zaneis	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.

*This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1----------------- Bergstrom	0-24	Silt loam--------	CL	A-4, A-6, A-7-6	0	95-100	95-100	95-100	85-97	28-46	8-25
	24-72	Silty clay loam, silt loam, clay loam.	CL	A-6, A-7	0	95-100	95-100	95-100	85-97	32-46	12-25
2----------------- Bergstrom	0-60	Silty clay loam	CL	A-4, A-6, A-7-6	0	95-100	95-100	95-100	85-97	28-46	8-25
3----------------- Bunyan	0-24	Loam-------------	SM-SC, SC, CL, CL-ML	A-4, A-6	0	100	95-100	70-95	40-75	20-35	3-16
	24-50	Stratified clay loam to fine sandy loam.	SC, CL, ML	A-4, A-6	0	100	95-100	80-100	40-95	20-40	8-25
	50-72	Stratified clay loam to fine sandy loam.	SC, CL, ML	A-6, A-7	0	100	95-100	80-95	45-95	30-45	11-25
4----------------- Burleson	0-40	Clay-------------	CH, MH	A-7-6, A-7-5	0-2	83-100	80-100	80-100	80-95	51-80	27-55
	40-80	Clay, silty clay	CH, MH	A-7-6, A-7-5	0-1	95-100	80-100	75-95	70-95	51-80	30-55
5----------------- Chickasha	0-12	Loam-------------	ML, CL-ML, SM, SM-SC	A-4	0	100	98-100	94-100	36-70	<26	NP-6
	12-24	Sandy clay loam, clay loam, loam.	CL, SC	A-4, A-6	0	100	100	90-100	40-70	28-39	9-18
	24-58	Sandy clay loam, loam.	CL, SC	A-4, A-6	0	98-100	98-100	90-100	40-70	26-37	8-16
	58-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
6----------------- Chickasha	0-12	Loam-------------	ML, CL-ML, SM, SM-SC	A-4	0	100	98-100	94-100	36-70	<26	NP-6
	12-25	Sandy clay loam, clay loam, loam.	CL, SC	A-4, A-6	0	100	100	90-100	40-70	28-39	9-18
	25-44	Sandy clay loam, loam.	CL, SC	A-4, A-6	0	98-100	98-100	90-100	40-70	26-37	8-16
	44-72	Weathered bedrock.	---	---	---	---	---	---	---	---	---
7----------------- Chickasha	0-11	Loam-------------	ML, CL-ML, SM, SM-SC	A-4	0	100	98-100	94-100	36-70	<26	NP-6
	11-32	Sandy clay loam, clay loam, loam.	CL, SC	A-4, A-6	0	100	100	90-100	40-70	28-39	9-18
	32-48	Sandy clay loam, loam.	CL, SC	A-4, A-6	0	98-100	98-100	90-100	40-70	26-37	8-16
	48-52	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
8*:											
Chigley-------------	0-6	Gravelly loam----	SM, SC	A-2, A-4	0	65-80	55-70	50-65	20-40	<30	NP-9
	6-42	Sandy clay, clay, gravelly clay.	CL, CH, SC	A-4, A-6, A-7	0	70-95	60-92	55-85	36-75	25-60	8-35
	42-44	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Darnell Variant----	0-5	Channery loam----	CL, GC, SC	A-2, A-4, A-6	0-15	50-75	50-75	45-75	32-75	30-37	9-14
	5-17	Very channery clay loam, very channery silt loam, very channery silty clay loam.	GC, GP-GC	A-2	0-15	10-35	10-35	10-35	7-35	30-40	9-15
	17-20	Weathered bedrock.	---	---	---	---	---	---	---	---	---
9------------------ Clarita	0-45	Silty clay-------	CL, CH, MH	A-7	0	95-100	95-100	90-100	80-95	45-70	25-45
	45-80	Clay--------------	CL, CH, MH	A-7	0	80-100	80-100	75-100	70-95	40-70	20-45
10----------------- Dale	0-15	Silt loam---------	ML, CL	A-4, A-6, A-7	0	100	100	96-100	65-98	30-43	8-20
	15-72	Silt loam, loam, silty clay loam.	ML, CL	A-4, A-6, A-7	0	100	100	96-100	65-98	30-43	8-20
11----------------- Durant	0-10	Loam--------------	CL, ML	A-4, A-6	0	100	100	96-100	65-97	28-40	4-20
	10-16	Clay loam, silty clay loam, clay	CL, CH, MH, ML	A-6, A-7	0	100	100	96-100	80-98	37-70	15-38
	16-80	Clay--------------	CL, CH, MH, ML	A-7	0	100	100	96-100	90-95	45-70	19-38
12----------------- Durant	0-10	Loam--------------	CL, ML	A-4, A-6	0	100	100	96-100	65-97	28-40	4-20
	10-15	Clay loam, silty clay loam, clay.	CL, CH, MH, ML	A-6, A-7	0	100	100	96-100	80-98	37-70	15-38
	15-72	Clay--------------	CL, CH, MH, ML	A-7	0	100	100	96-100	90-95	45-70	19-38
13----------------- Elandco	0-7	Clay loam---------	CL, ML, CL-ML	A-4, A-6, A-7-6	0	100	100	95-100	85-95	25-45	4-20
	7-65	Silty clay loam, clay loam, silt loam.	CL, ML, CL-ML	A-4, A-6, A-7-6	0	100	100	95-100	75-90	20-45	4-16
14----------------- Eufaula	0-80	Fine sand---------	SM, SP-SM	A-2, A-3	0	100	98-100	82-100	5-35	---	NP
15----------------- Healdton	0-6	Silt loam---------	CL, ML	A-4, A-6, A-7	0	100	100	96-100	80-98	30-42	8-19
	6-80	Silty clay, clay	CL, CH	A-7	0	95-100	95-100	95-100	90-98	41-60	18-32
16----------------- Heiden	0-9	Clay--------------	CH	A-7-6	0	95-100	90-100	80-100	75-99	54-80	35-55
	9-72	Clay, silty clay	CH	A-7-6	0	90-100	90-100	75-100	70-99	52-80	35-55
17----------------- Heiden	0-7	Clay--------------	CH	A-7-6	0	95-100	90-100	80-100	75-99	54-80	35-55
	7-72	Clay, silty clay	CH	A-7-6	0	90-100	90-100	75-100	70-99	52-80	35-55

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
18*:											
Kemp----------------	0-48	Loam-------------	SM-SC, CL-ML, CL, SC	A-4, A-6	0	100	100	90-100	40-80	20-35	7-20
	48-72	Silty clay loam, clay loam, loam.	CL, ML	A-6	0	100	100	85-95	51-80	25-50	11-30
Tullahassee--------	0-13	Loam-------------	SM, SC, ML, CL	A-4	0	100	98-100	90-100	36-85	<30	NP-10
	13-65	Fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	98-100	90-100	36-85	<30	NP-10
19*:											
Kiti----------------	0-15	Flaggy silty clay loam, very flaggy silty clay loam.	CL, ML	A-4, A-6	45-75	85-95	80-90	75-85	65-85	30-40	8-17
	15-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Grainola-----------	0-9	Gravelly clay loam.	CL, SC, GC	A-6, A-7	0-55	40-95	40-95	40-95	36-90	37-50	15-25
	9-20	Silty clay, silty clay loam, clay.	CL, CH	A-7	0	75-100	75-100	75-98	73-98	41-70	20-40
	20-30	Silty clay, silty clay loam, clay.	CL, CH, SC, GC	A-2, A-7	0	20-90	20-90	20-85	18-85	41-70	20-40
	30-65	Weathered bedrock.	---	---	---	---	---	---	---	---	---
20*:											
Kiti----------------	0-15	Channery silty clay loam, very flaggy silty clay loam.	CL, ML	A-4, A-6	45-75	85-95	80-90	75-85	65-85	30-40	8-17
	15-18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
21------------------ Konawa	0-12	Fine sandy loam	SP-SM, ML	A-4	0	98-100	98-100	90-100	40-60	<26	NP-7
	12-40	Fine sandy loam, sandy clay loam.	SP-SC, CL	A-4, A-6	0	98-100	98-100	85-100	40-60	21-34	4-14
	40-80	Loamy fine sand, fine sandy loam.	SM	A-2	0	98-100	98-100	85-100	15-35	---	NP
22------------------ Konawa	0-10	Fine sandy loam	SP-SM, ML	A-4	0	98-100	98-100	90-100	40-60	<26	NP-7
	10-60	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	98-100	98-100	85-100	40-60	26-40	8-18
	60-72	Fine sandy loam, sandy clay loam.	SP-SC, CL	A-4, A-6	0	98-100	98-100	85-100	40-60	21-34	4-14
23------------------ Konawa	0-13	Fine sandy loam	SP-SM, ML	A-4	0	98-100	98-100	90-100	40-60	<26	NP-7
	13-50	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	98-100	98-100	85-100	40-60	26-40	8-18
	50-72	Fine sandy loam, sandy clay loam.	SP-SC, CL	A-4, A-6	0	98-100	98-100	85-100	40-60	21-34	4-14

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
24------------------- Konsil	0-14	Loamy fine sand loam, fine sandy loam.	SM, SM-SC	A-2, A-4	0	90-100	90-99	50-75	20-40	<25	NP-4
	65-80	Weathered bedrock.	---	---	---	---	---	---	---	---	---
25------------------- Konsil	0-14	Loamy fine sand	SM, SM-SC	A-2, A-4	0	90-100	90-99	50-75	20-40	<25	NP-4
	14-65	Sandy clay loam, loam, fine sandy loam.	CL, SC	A-6	0	90-100	90-99	85-95	40-60	28-40	11-20
	65-70	Weathered bedrock.	---	---	---	---	---	---	---	---	---
26*:											
Konsil--------------	0-5	Loamy fine sand	SM, SM-SC	A-2, A-4	0	90-100	90-99	50-75	20-40	<25	NP-4
	5-75	Sandy clay loam, loam, fine sandy loam.	CL, SC	A-6	0	90-100	90-99	85-95	40-60	28-40	11-20
	75-85	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Weatherford--------	0-5	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0	95-100	95-100	75-90	30-60	<25	NP-7
	5-40	Sandy clay loam, clay loam.	SC, CL	A-6	0	95-100	95-100	80-100	36-60	30-40	15-24
	40-48	Sandy clay loam, clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	95-100	95-100	80-100	40-65	20-40	8-20
	48-55	Weathered bedrock.	---	---	---	---	---	---	---	---	---
27------------------- Lawton Variant	0-11	Clay loam--------	CL	A-6, A-7	0	90-100	90-100	90-100	80-90	34-43	13-20
	11-23	Clay, silty clay, silty clay loam.	CL	A-6, A-7	0	90-100	90-100	90-100	90-98	37-50	15-25
	23-80	Clay, silty clay	CL, CH	A-7	0	90-100	90-100	90-100	90-99	41-60	18-34
28------------------- Miller	0-44	Silty clay-------	CL, CH	A-6, A-7	0	100	98-100	96-100	80-99	35-60	15-35
	44-72	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	100	98-100	96-100	90-99	41-65	20-40
29*------------------ Miller	0-45	Clay-------------	CL, CH	A-6, A-7	0	100	98-100	96-100	80-99	35-60	15-35
	45-72	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	100	98-100	96-100	90-99	41-65	20-40
30------------------- Normangee	0-8	Loam-------------	CL	A-6, A-7	0	98-100	96-100	90-100	55-85	30-48	11-25
	8-60	Clay-------------	CL, CH	A-7	0	98-100	98-100	90-100	70-96	44-80	22-58
31------------------- Normangee	0-6	Loam-------------	CL	A-6, A-7	0	98-100	96-100	90-100	55-85	30-48	11-25
	6-80	Clay-------------	CL, CH	A-7	0	98-100	98-100	90-100	70-96	44-80	22-58
32------------------- Normangee	0-6	Clay loam--------	CL	A-6, A-7	0	98-100	96-100	90-100	55-85	30-48	11-25
	6-72	Clay-------------	CL, CH	A-7	0	98-100	98-100	90-100	70-96	44-80	22-58
33*. Oil-waste land											
34*. Pits											

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
35-------------------- Pulaski	0-8	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	95-100	90-100	36-85	<30	NP-10
	8-60	Fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	95-100	90-100	36-85	<30	NP-10
36*:											
Pulaski------------	0-20	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	95-100	90-100	36-85	<30	NP-10
	20-60	Fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	95-100	90-100	36-85	<30	NP-10
Bunyan-------------	0-24	Fine sandy loam	SM-SC, SC, CL, CL-ML	A-4, A-6	0	100	95-100	70-95	40-75	20-35	3-16
	24-60	Stratified clay loam to fine sandy loam.	SC, CL, ML	A-4, A-6	0	100	95-100	80-100	40-95	20-40	8-25
37-------------------- Renfrow	0-8	Silt loam--------	ML, CL	A-4, A-6	0	100	100	96-100	65-97	30-37	8-14
	8-12	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	96-100	80-98	37-49	15-26
	12-65	Clay, silty clay, silty clay loam.	ML, CL, CH, MH	A-6, A-7	0	100	100	96-100	80-99	37-70	15-38
38-------------------- Renfrow	0-11	Silt loam--------	ML, CL	A-4, A-6	0	100	100	96-100	65-97	30-37	8-14
	11-18	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	96-100	80-98	37-49	15-26
	18-60	Clay, silty clay, silty clay loam.	ML, CL, CH, MH	A-6, A-7	0	100	100	96-100	80-99	37-70	15-38
39*:											
Scullin------------	0-11	Clay loam--------	CL-ML, CL	A-4, A-6	0	75-95	55-93	55-80	55-65	23-34	6-14
	11-34	Clay, clay loam, gravelly clay.	CL, CH	A-7, A-6	0	65-75	55-75	55-70	55-65	37-57	16-32
	34-44	Unweathered bedrock.									
Kiti---------------	0-17	Silty clay loam	CL, ML	A-4, A-6	45-75	85-95	80-90	75-85	65-85	30-40	8-17
	17-28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
40-------------------- Steedman	0-4	Clay loam--------	CL	A-6, A-7	0-5	75-100	75-100	70-100	60-98	33-43	12-20
	4-36	Clay, silty clay	CL, CH	A-7	0	98-100	95-100	95-100	90-99	41-70	20-40
	36-50	Weathered bedrock.	---	---	---	---	---	---	---	---	---
41*:											
Stephenville-------	0-12	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	12-25	Fine sandy loam, sandy clay loam.	SC, CL	A-4, A-6	0	100	98-100	90-100	36-65	25-37	7-16
	25-42	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Darnell------------	0-6	Fine sandy loam	SM, SC, ML, CL	A-4	0-5	90-100	90-100	85-100	36-60	<30	NP-10
	6-13	Fine sandy loam, loam.	SM, SC, ML, CL	A-4	0-8	70-100	70-100	60-100	36-60	<30	NP-10
	13-18	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
42*:											
Tamford------------	0-6	Clay loam--------	CL	A-6, A-7	0	100	100	96-100	80-98	37-50	15-26
	6-54	Clay-------------	CL, CH	A-7	0	100	100	96-100	90-95	45-70	25-45
	54-72	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Grainola-----------	0-3	Silty clay loam	CL, SC, GC	A-6, A-7	0-55	40-95	40-95	40-95	36-90	37-50	15-25
	3-20	Silty clay loam, silty clay, clay loam.	CL, CH	A-7	0-15	75-90	75-90	75-90	70-90	41-70	20-40
	20-32	Silty clay, silty clay loam, clay.	CL, CH	A-7	0	75-100	75-100	75-98	73-98	41-70	20-40
	32-72	Weathered bedrock.	---	---	---	---	---	---	---	---	---
43------------------ Watonga	0-80	Silty clay-------	CL, CH	A-7	0	100	98-100	96-100	80-99	41-70	20-45
44------------------ Weatherford	0-8	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0	95-100	95-100	75-90	30-60	<25	NP-7
	8-50	Sandy clay loam, clay loam.	SC, CL	A-6	0	95-100	95-100	80-100	36-60	30-40	15-24
	50-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
45------------------ Weatherford	0-11	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0	95-100	95-100	75-90	30-60	<25	NP-7
	11-44	Sandy clay loam, clay loam.	SC, CL	A-6	0	95-100	95-100	80-100	36-60	30-40	15-24
	44-50	Weathered bedrock.	---	---	---	---	---	---	---	---	---
46------------------ Weatherford	0-4	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0	95-100	95-100	75-90	30-60	<25	NP-7
	4-58	Sandy clay loam, clay loam.	SC, CL	A-6	0	95-100	95-100	80-100	36-60	30-40	15-24
	58-65	Weathered bedrock.	---	---	---	---	---	---	---	---	---
47*:											
Weatherford--------	0-11	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0	95-100	95-100	75-90	30-60	<25	NP-7
	11-56	Sandy clay loam, clay loam.	SC, CL	A-6	0	95-100	95-100	80-100	36-60	30-40	15-24
	56-72	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Duffau-------------	0-15	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0	95-100	95-100	75-90	30-60	<25	NP-7
	15-66	Sandy clay loam, clay loam, loam.	SC, CL	A-6	0	95-100	95-100	80-100	36-65	30-40	15-24
	66-80	Sandy clay loam, loam, fine sandy loam.	SC, CL, CL-ML, SM	A-4, A-6	0	95-100	95-100	80-100	40-65	20-36	2-18

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
48---------------- Weswood	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	70-95	20-35	4-15
	6-80	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-98	30-46	11-26
49---------------- Wilson	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	95-100	85-100	80-100	60-96	24-36	7-18
	8-80	Silty clay, clay, clay loam.	CL, CH	A-7-6 A-6	0	90-100	80-100	80-100	95-65	40-55	21-35
50---------------- Wilson	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	95-100	85-100	80-100	60-96	24-36	7-18
	8-60	Silty clay, clay	CL, CH	A-7-6, A-6	0	95-100	90-100	85-100	70-90	40-57	24-35
51---------------- Windthorst	0-11	Fine sandy loam	SM, SM-SC, CL-ML	A-4	0	95-100	90-100	75-100	36-75	<28	NP-7
	11-34	Clay, sandy clay, clay loam.	CL, CH	A-6, A-7-6	0	95-100	95-100	85-100	51-90	35-53	20-35
	34-65	Sandy clay loam, clay, fine sandy loam.	SC, CL	A-4, A-6, A-7-6	0	85-100	80-100	75-100	36-90	25-45	8-28
52---------------- Windthorst	0-5	Fine sandy loam	SM, SM-SC, CL-ML	A-4	0	95-100	90-100	75-100	36-75	<28	NP-7
	5-32	Clay, sandy clay, clay loam.	CL, CH	A-6, A-7-6	0	95-100	95-100	85-100	51-90	35-53	20-35
	32-47	Sandy clay loam, clay, fine sandy loam.	SC, CL	A-4, A-6, A-7-6	0	85-100	80-100	75-100	36-90	25-45	8-28
	47-62	Stratified variable.	---	---	---	---	---	---	---	---	---
53---------------- Windthorst	0-6	Fine sandy loam	SM, SM-SC, CL-ML	A-4	0	95-100	90-100	75-100	36-75	<28	NP-7
	6-26	Clay, sandy clay, clay loam.	CL, CH	A-6, A-7-6	0	95-100	95-100	85-100	51-90	35-53	20-35
	26-65	Sandy clay loam, clay, fine sandy loam.	SC, CL	A-4, A-6, A-7-6	0	85-100	80-100	75-100	36-90	25-45	8-28
54*:											
Windthorst---------	0-3	Fine sandy loam	SM, SM-SC, CL-ML	A-4	0	95-100	90-100	75-100	36-75	<28	NP-7
	3-28	Clay, sandy clay, clay loam.	CL, CH	A-6, A-7-6	0	95-100	95-100	85-100	51-90	35-53	20-35
	28-48	Sandy clay loam, clay, fine sandy loam.	SC, CL	A-4, A-6, A-7-6	0	85-100	80-100	75-100	36-90	25-45	8-28
	48-52	Stratified variable.	---	---	---	---	---	---	---	---	---
Darnell------------	0-6	Extremely stony fine sandy loam.	SM, SC, ML, CL	A-4	5-25	90-100	90-100	85-100	36-60	<30	NP-10
	6-16	Fine sandy loam, loam.	SM, SC, ML, CL	A-4	0-8	70-100	70-100	60-100	36-60	<30	NP-10
	16-28	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
55*:											
Windthorst----------	0-6	Fine sandy loam	SM, SM-SC, CL-ML	A-4	0	95-100	90-100	75-100	36-75	<28	NP-7
	6-42	Clay, sandy clay, clay loam.	CL, CH	A-6, A-7-6	0	95-100	95-100	85-100	51-90	35-53	20-35
	42-65	Stratified variable.	---	---	---	---	---	---	---	---	---
Weatherford--------	0-9	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0	95-100	95-100	75-90	30-60	<25	NP-7
	9-55	Sandy clay loam, clay loam.	SC, CL	A-6	0	95-100	95-100	80-100	36-60	30-40	15-24
	55-65	Weathered bedrock.	---	---	---	---	---	---	---	---	---
56------------------ Woodford	0-17	Silt loam, very channery silt loam.	CL, SC, GC	A-2, A-4, A-6	10-65	45-90	45-90	40-90	30-85	25-33	7-12
	17-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
57*----------------- Yahola	0-13	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	95-100	90-100	36-85	<30	NP-10
	13-38	Fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	95-100	90-100	36-85	<30	NP-10
	38-72	Fine sandy loam, loam, loamy fine sand.	SM, SC, ML, CL	A-4, A-2	0	100	95-100	90-100	15-85	<30	NP-10
58------------------ Zaneis	0-12	Loam-------------	SM, SC, ML, CL	A-4	0	100	98-100	94-100	36-85	<31	NP-10
	12-39	Loam, clay loam, sandy clay loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0	100	100	90-100	36-90	25-40	7-18
	39-48	Clay loam, sandy clay loam, fine sandy loam.	SM, SC, ML, CL	A-4, A-6	0-7	90-100	90-100	85-100	36-90	20-40	2-18
	48-72	Weathered bedrock.	---	---	---	---	---	---	---	---	---

* See mapping unit description for the composition and behavior of the mapping unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH						
1	0-24	0.6-2.0	0.16-0.20	7.9-8.4	Moderate	Moderate	Low	0.37	5	---
Bergstrom	24-72	0.6-2.0	0.16-0.20	7.9-8.4	Moderate	Moderate	Low	0.43		
2	0-60	0.6-2.0	0.16-0.20	7.9-8.4	Moderate	Moderate	Low	0.37	5	---
Bergstrom										
3	0-24	2.0-6.0	0.11-0.15	6.1-7.3	Low	Low	Low	0.43	5	---
Bunyan	24-50	0.6-2.0	0.15-0.19	5.6-8.4	Low	Moderate	Low	0.43		
	50-72	0.6-2.0	0.18-0.22	6.6-8.4	Low	Moderate	Low	0.43		
4	0-40	<0.06	0.12-0.18	5.6-8.4	High	High	Low	0.32	5	---
Burleson	40-80	<0.06	0.12-0.18	7.4-8.4	High	High	Low	0.32		
5	0-12	2.0-6.0	0.13-0.17	5.6-7.3	Low	Low	Moderate	0.37	4	---
Chickasha	12-24	0.6-2.0	0.14-0.18	5.6-7.3	Low	Moderate	Moderate	0.37		
	24-58	0.6-2.0	0.13-0.17	5.6-8.4	Low	Moderate	Moderate	0.37		
	58-60	---	---	---	---	---	---	---		
6	0-12	2.0-6.0	0.13-0.17	5.6-7.3	Low	Low	Moderate	0.37	4	---
Chickasha	12-25	0.6-2.0	0.14-0.18	5.6-7.3	Low	Moderate	Moderate	0.37		
	25-44	0.6-2.0	0.13-0.17	5.6-8.4	Low	Moderate	Moderate	0.37		
	44-72	---	---	---	---	---	---	---		
7	0-11	2.0-6.0	0.13-0.17	5.6-7.3	Low	Low	Moderate	0.37	4	---
Chickasha	11-32	0.6-2.0	0.14-0.18	5.6-7.3	Low	Moderate	Moderate	0.37		
	32-48	0.6-2.0	0.13-0.17	5.6-8.4	Low	Moderate	Moderate	0.37		
	48-52	---	---	---	---	---	---	---		
8*:										
Chigley	0-6	2.0-6.0	0.09-0.13	5.1-7.3	Low	Moderate	Low	0.32	4	---
	6-42	0.2-0.6	0.14-0.18	5.1-7.8	Moderate	High	Moderate	0.28		
	42-44	0.6-2.0	0.10-0.14	6.6-8.4	Moderate	High	Low	---		
Darnell Variant	0-5	0.6-2.0	0.10-0.20	5.6-6.5	Low	Low	Moderate	0.32	1	---
	5-17	0.6-2.0	0.05-0.15	4.5-6.0	Low	Low	Moderate	0.32		
	17-20	---	---	---	---	---	---	---		
9	0-45	<0.06	0.12-0.20	6.6-8.4	High	High	Low	0.43	4	---
Clarita	45-80	<0.06	0.12-0.18	7.9-8.4	High	High	Low	0.37		
10	0-15	0.6-2.0	0.15-0.24	6.1-8.4	Moderate	Moderate	Low	0.37	5	---
Dale	15-72	0.6-2.0	0.15-0.24	6.6-8.4	Moderate	Moderate	Low	0.37		
11	0-10	0.60-2.0	0.15-0.24	5.6-6.5	Low	High	Moderate	0.49	5	---
Durant	10-16	<0.06	0.12-0.22	5.1-6.5	Moderate	High	Moderate	0.43		
	16-80	<0.06	0.12-0.18	5.6-8.4	High	High	Moderate	0.37		
12	0-10	0.60-2.0	0.15-0.24	5.6-6.5	Low	High	Moderate	0.49	5	---
Durant	10-15	<0.06	0.12-0.22	5.1-6.5	Moderate	High	Moderate	0.43		
	15-72	<0.06	0.12-0.18	5.6-8.4	High	High	Moderate	0.37		
13	0-7	0.6-2.0	0.15-0.22	6.6-8.4	Moderate	Moderate	Low	0.37	5	---
Elandco	7-65	0.6-2.0	0.15-0.22	7.4-8.4	Moderate	Moderate	Low	0.43		
14	0-80	6.0-20.0	0.05-0.11	5.1-7.3	Low	Low	Moderate	0.17	5	1
Eufaula										
15	0-6	0.2-2.0	0.10-0.20	5.6-7.3	Low	Moderate	Low	0.49	1	---
Healdton	6-80	<0.06	0.06-0.15	6.6-8.4	High	High	Low	0.37		
16	0-9	<0.06	0.15-0.20	7.9-8.4	Very high	High	Low	0.32	5	---
Heiden	9-72	<0.06	0.12-0.20	7.9-8.4	Very high	High	Low	0.32		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea-bility	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodi-bility group
	In	In/hr	In/in	pH						
17----------------- Heiden	0-7	<0.06	0.15-0.20	7.4-8.4	Very high	High-----	Low------	0.32	5	---
	7-72	<0.06	0.12-0.20	7.9-8.4	Very high	High-----	Low------	0.32		
18*:										
Kemp---------------	0-48	0.6-2.0	0.13-0.20	5.1-6.5	Low--------	Moderate	Moderate	0.28	5	---
	48-72	0.6-2.0	0.12-0.18	5.1-7.3	Moderate	Moderate	Moderate	0.28		
Tullahassee--------	0-13	2.0-6.0	0.12-0.16	5.6-6.5	Low--------	Moderate	Moderate	0.32	5	---
	13-65	2.0-6.0	0.12-0.16	5.6-6.5	Low--------	Moderate	Moderate	0.32		
19*:										
Kiti---------------	0-15	0.6-2.0	0.07-0.11	6.6-8.4	Moderate	Moderate	Low------	0.28	1	---
	15-20	---	---	---	-----------	----------	----------	---		
Grainola-----------	0-9	0.2-0.6	0.10-0.20	7.4-8.4	Moderate	High-----	Low------	0.37	3	---
	9-20	0.06-0.2	0.12-0.20	7.4-8.4	High-------	High-----	Low------	---		
	20-30	0.06-0.2	0.05-0.18	7.4-8.4	High-------	High-----	Low------	---		
	30-65	---	---	---	-----------	----------	----------	---		
20*:										
Kiti---------------	0-15	0.6-2.0	0.07-0.11	6.6-8.4	Moderate	Moderate	Low------	0.28	1	---
	15-18	---	---	---	-----------	----------	----------	---		
Rock outcrop.										
21----------------- Konawa	0-12	2.0-6.0	0.11-0.15	5.6-6.5	Low--------	Low------	Moderate	0.24	5	---
	12-40	2.0-6.0	0.11-0.15	5.1-7.3	Low--------	Low------	Moderate	0.24		
	40-80	6.0-20.0	0.07-0.11	5.1-7.3	Low--------	Low------	Moderate	0.24		
22----------------- Konawa	0-10	2.0-6.0	0.11-0.15	5.6-6.5	Low--------	Low------	Moderate	0.24	5	---
	10-60	0.6-2.0	0.12-0.16	5.1-6.0	Low--------	Moderate	Moderate	0.32		
	60-72	2.0-6.0	0.11-0.15	5.1-7.3	Low--------	Low------	Moderate	0.24		
23----------------- Konawa	0-13	2.0-6.0	0.11-0.15	5.6-6.5	Low--------	Low------	Moderate	0.24	5	---
	13-50	0.6-2.0	0.12-0.16	5.1-6.0	Low--------	Moderate	Moderate	0.32		
	50-72	2.0-6.0	0.11-0.15	5.1-7.3	Low--------	Low------	Moderate	0.24		
24----------------- Konsil	0-14	6.0-20	0.07-0.11	6.1-7.8	Low--------	Low------	Low------	0.20	5	2
	14-65	0.6-2.0	0.12-0.19	5.1-6.5	Moderate	Low------	Moderate	0.32		
	65-80	---	---	---	-----------	----------	----------	---		
25----------------- Konsil	0-14	6.0-20	0.07-0.11	6.1-7.8	Low--------	Low------	Low------	0.20	5	2
	14-65	0.6-2.0	0.12-0.19	5.1-6.5	Moderate	Low------	Moderate	0.32		
	65-70	---	---	---	-----------	----------	----------	---		
26*:										
Konsil-------------	0-5	6.0-20	0.07-0.11	6.1-7.8	Low--------	Low------	Low------	0.20	5	2
	5-75	0.6-2.0	0.12-0.19	5.1-6.5	Moderate	Low------	Moderate	0.32		
	75-85	---	---	---	-----------	----------	----------	---		
Weatherford--------	0-5	2.0-6.0	0.11-0.15	6.1-7.3	Low--------	Low------	Low------	0.43	3	---
	5-40	0.6-2.0	0.12-0.19	5.6-6.5	Low--------	Low------	Moderate	0.49		
	40-48	0.6-2.0	0.10-0.15	5.6-6.5	Low--------	Low------	Moderate	0.49		
	48-55	---	---	---	-----------	----------	----------	---		
27----------------- Lawton Variant	0-11	0.2-2.0	0.15-0.20	6.1-7.3	Moderate	Moderate	Low------	0.32	5	---
	11-23	0.2-0.6	0.12-0.20	6.6-7.8	High-------	High-----	Low------	0.32		
	23-80	0.2-0.6	0.12-0.18	6.6-8.4	High-------	High-----	Low------	0.28		
28----------------- Miller	0-34	0.06-0.2	0.16-0.2	7.4-8.4	High-------	High-----	Low------	0.43	5	---
	34-44	<0.06	0.15-0.19	7.4-8.4	High-------	High-----	Low------	0.43		
	44-72	0.06-0.2	0.15-0.19	7.9-8.4	High-------	High-----	Low------	0.43		
29*---------------- Miller	0-35	0.06-0.2	0.16-0.2	7.4-8.4	High-------	High-----	Low------	0.43	5	---
	35-45	<0.06	0.15-0.19	7.4-8.4	High-------	High-----	Low------	0.43		
	45-72	0.06-0.2	0.15-0.19	7.9-8.4	High-------	High-----	Low------	0.43		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea- bility	Available water capacity	Soil reaction	Shrink- swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodi- bility group
	In	In/hr	In/in	pH						
30-------------------- Normangee	0-8	0.06-0.2	0.15-0.20	5.6-7.3	Moderate	High------	Low-------	0.32	4	---
	8-60	<0.06	0.12-0.18	5.6-8.4	High-------	High------	Low-------	0.32		
31-------------------- Normangee	0-6	0.06-0.2	0.15-0.20	5.6-7.3	Moderate	High------	Low-------	0.32	4	---
	6-80	<0.06	0.12-0.18	5.6-8.4	High-------	High------	Low-------	0.32		
32-------------------- Normangee	0-6	0.06-0.2	0.15-0.20	5.6-7.3	Moderate	High------	Low-------	0.32	4	---
	6-72	<0.06	0.12-0.18	5.6-8.4	High-------	High------	Low-------	0.32		
33*. Oil-waste land										
34*. Pits										
35-------------------- Pulaski	0-8	2.0-6.0	0.12-0.16	5.6-7.3	Low--------	Low-------	Moderate	0.32	5	---
	8-60	2.0-6.0	0.12-0.16	5.6-7.3	Low--------	Low-------	Moderate	0.32		
36*:										
Pulaski-------------	0-20	2.0-6.0	0.12-0.16	5.6-7.3	Low--------	Low-------	Moderate	0.32	5	---
	20-60	2.0-6.0	0.12-0.16	5.6-7.3	Low--------	Low-------	Moderate	0.32		
Bunyan--------------	0-24	2.0-6.0	0.11-0.15	6.1-7.3	Low--------	Low-------	Low-------	0.43	5	---
	24-60	0.6-2.0	0.15-0.19	5.6-8.4	Low--------	Moderate	Low-------	0.43		
37-------------------- Renfrow	0-8	0.6-2.0	0.15-0.24	6.1-7.8	Low--------	Low-------	Low-------	0.49	4	---
	8-12	0.2-0.6	0.15-0.22	6.1-7.8	Moderate	Moderate	Low-------	0.43		
	12-65	<0.06	0.12-0.22	6.1-8.4	High-------	High------	Low-------	0.43		
38-------------------- Renfrow	0-11	0.6-2.0	0.15-0.24	6.1-7.8	Low--------	Low-------	Low-------	0.49	4	---
	11-18	0.2-0.6	0.15-0.22	6.1-7.8	Moderate	Moderate	Low-------	0.43		
	18-60	<0.06	0.12-0.22	6.1-8.4	High-------	High------	Low-------	0.43		
39*:										
Scullin-------------	0-11	0.6-2.0	0.15-0.19	5.6-6.5	Low--------	Low-------	Moderate	0.32	2	---
	11-34	0.6-2.0	0.12-0.16	5.6-6.5	Moderate	Moderate	Moderate	0.32		
	34-44	---	---	---	-----------	----------	----------	----		
Kiti----------------	0-17	0.6-2.0	0.07-0.11	6.6-8.4	Moderate	Moderate	Low-------	0.28	1	---
	17-28	---	---	---	-----------	----------	----------	----		
40-------------------- Steedman	0-4	0.2-0.6	0.12-0.20	5.1-6.5	Moderate	Moderate	Moderate	0.32	3	---
	4-36	0.06-0.2	0.12-0.18	5.6-8.4	High-------	High------	Low-------	0.32		
	36-50	---	---	---	-----------	----------	----------	----		
41*:										
Stephenville--------	0-12	2.0-6.0	0.11-0.15	5.1-7.3	Low--------	Low-------	Moderate	0.24	3	---
	12-25	0.6-2.0	0.11-0.17	5.1-6.5	Low--------	Moderate	Moderate	0.32		
	25-42	---	---	---	-----------	----------	----------	----		
Darnell-------------	0-6	2.0-6.0	0.12-0.16	5.1-7.3	Low--------	Low-------	Moderate	0.20	2	---
	6-13	2.0-6.0	0.12-0.16	5.1-7.3	Low--------	Low-------	Moderate	0.32		
	13-18	---	---	---	-----------	----------	----------	----		
42*:										
Tamford-------------	0-6	0.06-0.6	0.12-0.20	6.1-8.4	High-------	High------	Low-------	0.43	4	---
	6-54	<0.06	0.12-0.18	7.4-8.4	High-------	High------	Low-------	0.37		
	54-72	---	---	---	-----------	----------	----------	----		
Grainola------------	0-3	0.2-0.6	0.10-0.20	7.4-8.4	Moderate	High------	Low-------	0.37	3	---
	3-20	0.06-0.2	0.10-0.20	7.4-8.4	High-------	High------	Low-------	0.32		
	20-32	0.06-0.2	0.12-0.20	7.4-8.4	High-------	High------	Low-------	----		
	32-72	---	---	---	-----------	----------	----------	----		
43-------------------- Watonga	0-80	<0.06	0.15-0.19	6.6-8.4	High-------	High------	Low-------	0.43	5	---

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH						
44	0-8	2.0-6.0	0.11-0.15	6.1-7.3	Low	Low	Low	0.43	3	---
Weatherford	8-50	0.6-2.0	0.12-0.19	5.6-6.5	Low	Low	Moderate	0.49		
	50-60	---	---	---	---	---	---	---		
45	0-11	2.0-6.0	0.11-0.15	6.1-7.3	Low	Low	Low	0.43	3	---
Weatherford	11-44	0.6-2.0	0.12-0.19	5.6-6.5	Low	Low	Moderate	0.49		
	44-50	---	---	---	---	---	---	---		
46	0-4	2.0-6.0	0.11-0.15	6.1-7.3	Low	Low	Low	0.43	3	---
Weatherford	4-58	0.6-2.0	0.12-0.19	5.6-6.5	Low	Low	Moderate	0.49		
	58-65	---	---	---	---	---	---	---		
47*:										
Weatherford	0-11	2.0-6.0	0.11-0.15	6.1-7.3	Low	Low	Low	0.43	3	---
	11-56	0.6-2.0	0.12-0.19	5.6-6.5	Low	Low	Moderate	0.49		
	56-72	---	---	---	---	---	---	---		
Duffau	0-15	2.0-6.0	0.11-0.15	6.1-7.8	Low	Low	Low	0.43	5	---
	15-66	0.6-2.0	0.12-0.19	6.1-7.8	Low	Moderate	Low	0.32		
	66-80	0.6-2.0	0.10-0.15	6.1-7.8	Low	Moderate	Low	0.32		
48	0-6	0.6-2.0	0.15-0.20	7.9-8.4	Low	High	Low	0.43	5	---
Weswood	6-80	0.6-2.0	0.15-0.22	7.9-8.4	Low	High	Low	0.43		
49	0-8	0.2-0.6	0.15-0.20	5.6-7.8	Low	High	Low	0.43	5	---
Wilson	8-80	<0.06	0.14-0.20	5.6-7.8	High	High	Low	0.37		
50	0-8	0.2-0.6	0.15-0.20	5.6-7.8	Low	High	Low	0.43	5	---
Wilson	8-60	<0.06	0.14-0.20	5.6-7.8	High	High	Low	0.37		
51	0-11	0.6-2.0	0.12-0.17	5.6-7.3	Low	Low	Low	0.49	5	---
Windthorst	11-34	0.2-0.6	0.15-0.20	5.6-7.3	Moderate	High	Low	0.37		
	34-65	0.2-0.6	0.12-0.20	5.6-8.4	Moderate	Moderate	Low	0.37		
52	0-5	0.6-2.0	0.12-0.17	5.6-7.3	Low	Low	Low	0.49	5	---
Windthorst	5-32	0.2-0.6	0.15-0.20	5.6-7.3	Moderate	High	Low	0.37		
	32-47	0.2-0.6	0.12-0.20	5.6-8.4	Moderate	Moderate	Low	0.37		
	47-62	---	---	---	---	---	---	---		
53	0-6	0.6-2.0	0.12-0.17	5.6-7.3	Low	Low	Low	0.49	5	---
Windthorst	6-26	0.2-0.6	0.15-0.20	5.6-7.3	Moderate	High	Low	0.37		
	26-65	0.2-0.6	0.12-0.20	5.6-8.4	Moderate	Moderate	Low	0.37		
54*:										
Windthorst	0-3	0.6-2.0	0.12-0.17	5.6-7.3	Low	Low	Low	0.49	5	---
	3-28	0.2-0.6	0.15-0.20	5.6-7.3	Moderate	High	Low	0.37		
	28-48	0.2-0.6	0.12-0.20	5.6-8.4	Moderate	Moderate	Low	0.37		
	48-52	---	---	---	---	---	---	---		
Darnell	0-6	2.0-6.0	0.12-0.16	5.1-7.3	Low	Low	Moderate	0.15	2	---
	6-16	2.0-6.0	0.12-0.16	5.1-7.3	Low	Low	Moderate	0.32		
	16-28	---	---	---	---	---	---	---		
55*:										
Windthorst	0-6	0.6-2.0	0.12-0.17	5.6-7.3	Low	Low	Low	0.49	5	---
	6-42	0.2-0.6	0.15-0.20	5.6-7.3	Moderate	High	Low	0.37		
	42-65	---	---	---	---	---	---	---		
Weatherford	0-9	2.0-6.0	0.11-0.15	6.1-7.3	Low	Low	Low	0.43	3	---
	9-55	0.6-2.0	0.12-0.19	5.6-6.5	Low	Low	Moderate	0.49		
	55-65	---	---	---	---	---	---	---		
56	0-17	0.6-2.0	0.08-0.20	6.1-8.4	Low	Low	Low	0.28	1	---
Woodford	17-20	---	---	---	---	---	---	---		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH						
57*: Yahola	0-13	2.0-6.0	0.12-0.16	7.4-8.4	Low	Low	Low	0.32	5	---
	13-38	2.0-6.0	0.12-0.16	7.9-8.4	Low	Low	Low	0.32		
	38-72	2.0-6.0	0.07-0.16	7.9-8.4	Low	Low	Low	0.32		
58: Zaneis	0-12	0.6-2.0	0.11-0.20	5.6-7.3	Low	Low	Low	0.37	4	---
	12-39	0.2-0.6	0.12-0.20	5.6-7.3	Moderate	Moderate	Low	0.37		
	39-48	0.2-2.0	0.11-0.20	6.1-7.8	Moderate	Moderate	Low	0.32		
	48-72	---	---	---	---	---	---	---		

* See mapping unit description for the composition and behavior of the mapping unit.

TABLE 16.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See text for descriptions of symbols and such terms as "rare," "brief," and "perched." The symbol < means less than; > means greater than]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
1, 2: Bergstrom	B	Occasional	Brief	Mar-Sep	>6.0	---	---	>60	---
3: Bunyan	B	Occasional	Brief	May-Oct	>6.0	---	---	>60	---
4: Burleson	D	None	---	---	>6.0	---	---	>60	---
5, 6, 7: Chickasha	B	None	---	---	>6.0	---	---	40-60	Rippable
8*:									
Chigley	C	None	---	---	3.0-4.0	Perched	Feb-May	40-60	Rippable
Darnell Variant	C	None	---	---	>6.0	---	---	8-20	Rippable
9: Clarita	D	None	---	---	>6.0	---	---	>60	---
10: Dale	B	Rare	---	May	>6.0	---	---	>60	---
11, 12: Durant	D	None	---	---	>6.0	---	---	>60	---
13: Elandco	B	Occasional	Brief	Mar-Sep	>6.0	---	---	>60	---
14: Eufaula	A	None	---	---	>6.0	---	---	>60	---
15: Healdton	D	Occasional	Very brief	Mar-Oct	0.5-1.5	Perched	Nov-Apr	>60	---
16, 17: Heiden	D	None	---	---	>6.0	---	---	>60	---
18*:									
Kemp	C	Frequent	Very brief to brief.	Mar-Sep	2.0-3.0	Apparent	Nov-May	>60	---
Tullahassee	C	Frequent	Very brief to long.	Mar-Aug	2.0-3.0	Apparent	Nov-May	>60	---
19*:									
Kiti	C	None	---	---	>6.0	---	---	4-20	Hard
Grainola	D	None	---	---	>6.0	---	---	20-40	Rippable
20*:									
Kiti	C	None	---	---	>6.0	---	---	4-20	Hard
Rock outcrop.									
21, 22, 23: Konawa	B	None	---	---	>6.0	---	---	>60	---
24, 25: Konsil	B	None	---	---	>6.0	---	---	>60	Rippable
26*:									
Konsil	B	None	---	---	>6.0	---	---	>60	Rippable

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
26*:									
Weatherford------	B	None---------	---	---	>6.0	---	---	40-60	Rippable
27----------------- Lawton Variant	C	None---------	---	---	>6.0	---	---	>60	---
28, 29*----------- Miller	D	Common-------	Brief-----	Mar-Sep	>6.0	---	---	>60	---
30, 31, 32-------- Normangee	D	None---------	---	---	>6.0	---	---	>60	---
33*. Oil-waste land.									
34*. Pits.									
35----------------- Pulaski	B	Occasional--	Very brief	Mar-Aug	>6.0	---	---	>60	---
36*:									
Pulaski-----------	B	Frequent-----	Very brief	Mar-Aug	>6.0	---	---	>60	---
Bunyan------------	B	Frequent-----	Brief-----	May-Oct	>6.0	---	---	>60	---
37, 38------------ Renfrow	D	None---------	---	---	>6.0	---	---	>60	---
39*:									
Scullin-----------	C	None---------	---	---	>6.0	---	---	20-40	Hard
Kiti--------------	C	None---------	---	---	>6.0	---	---	4-20	Hard
40----------------- Steedman	D	None---------	---	---	0.5-1.0	Perched	Nov-Mar	20-40	Rippable
41*:									
Stephenville------	B	None---------	---	---	>6.0	---	---	20-40	Rippable
Darnell-----------	C	None---------	---	---	>6.0	---	---	10-20	Rippable
42*:									
Tamford-----------	D	None---------	---	---	>6.0	---	---	>60	---
Grainola----------	D	None---------	---	---	>6.0	---	---	20-40	Rippable
43----------------- Watonga	D	Occasional--	Very brief	Mar-Sep	>6.0	---	---	>60	---
44, 45, 46-------- Weatherford	B	None---------	---	---	>6.0	---	---	40-60	Rippable
47*:									
Weatherford------	B	None---------	---	---	>6.0	---	---	40-60	Rippable
Duffau------------	B	None---------	---	---	>6.0	---	---	>60	Rippable
48----------------- Weswood	B	Occasional--	Brief-----	Mar-Sep	>6.0	---	---	>60	---
49, 50------------ Wilson	D	None---------	---	---	0-1.0	Perched	Nov-Mar	>60	---
51, 52, 53-------- Windthorst	C	None---------	---	---	>6.0	---	---	>60	---

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
54*:									
Windthorst	C	None	---	---	>6.0	---	---	>60	---
Darnell	C	None	---	---	>6.0	---	---	10-20	Rippable
55*:									
Windthorst	C	None	---	---	>6.0	---	---	>60	---
Weatherford	B	None	---	---	>6.0	---	---	40-60	Rippable
56 Woodford	C	None	---	---	>6.0	---	---	5-20	Hard
57* Yahola	B	Frequent	Very brief	Mar-Aug	>6.0	---	---	>60	---
58 Zaneis	B	None	---	---	>6.0	---	---	40-60	Rippable

* See mapping unit description for the composition and behavior of the mapping unit.

TABLE 17.--ENGINEERING TEST DATA

[Dashes indicate data were not available. NP means nonplastic. TR means trace.]

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution							Liquid limit	Plasticity index	Shrinkage		
			Percentage passing sieve				Percentage smaller than--							
	AASHTO	Unified	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm			Limit	Linear	Ratio
										Pct		Pct	Pct	Pct
Chickasha loam: (S68OK-010-001)														
A1---------------- 0 to 12	A-4 (00)	SM	100	100	99	37	32	17	13	--	NP	0.0	0.0	0.0
B22t--------------- 24 to 44	A-6 (06)	CL	100	100	99	53	48	40	36	39	16	12.0	0.0	1.9
B3----------------- 44 to 58	A-6 (02)	SC	100	100	98	45	42	34	28	31	13	12.0	0.0	1.9
Durant loam: (S68OK-010-002)														
A1---------------- 0 to 10	A-4 (05)	CL	100	100	98	74	60	24	22	30	8	16.0	0.0	1.7
B22t--------------- 16 to 31	A-7-5(23)	MH	100	100	99	86	81	50	46	55	22	10.0	0.0	2.0
B23t--------------- 31 to 45	A-7-6(26)	CH	100	100	99	86	79	47	44	54	27	10.0	0.0	2.0
Elandco clay loam: (S68OK-010-003)														
A12--------------- 7 to 16	A-7-6(17)	CL	100	100	100	91	85	46	37	42	17	11.0	0.0	1.9
B21---------------- 16 to 32	A-7-6(19)	CL	100	100	100	90	84	44	38	43	19	10.0	0.0	2.0
C------------------ 48 to 65	A-6 (10)	CL	100	100	99	81	72	30	24	34	14	12.0	0.0	1.9
Pulaski fine sandy loam: (S68OK-010-004)														
A1---------------- 0 to 8	A-2-4(00)	SM	100	100	97	30	21	4	3	--	NP	--	0.0	--
C------------------ 24 to 60	A-2-4(00)	SM	100	100	98	24	17	10	6	--	NP	--	0.0	--
Windthorst fine sandy loam: (S68OK-010-005)														
A1---------------- 0 to 3	A-4 (00)	ML	100	100	96	53	35	10	7	--	NP	--	0.0	--
B21t--------------- 6 to 18	A-7-6(20)	CL	100	100	99	96	85	46	44	41	19	12.0	0.0	1.9
B22t--------------- 18 to 37	A-6 (11)	CL	100	100	99	75	66	42	38	36	16	10.0	0.0	1.9
B31---------------- 37 to 52	A-7-6(19)	CL	100	100	98	85	77	54	50	44	22	12.0	0.0	1.9
B32---------------- 52 to 65	A-6 (18)	CL	100	100	98	93	89	50	38	39	18	12.0	0.0	1.9

TABLE 18.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Bergstrom	Fine-silty, mixed, thermic Cumulic Haplustolls
Bunyan	Fine-loamy, mixed, nonacid, thermic Typic Ustifluvents
Burleson	Fine, montmorillonitic, thermic Udic Pellusterts
Chickasha	Fine-loamy, mixed, thermic Udic Argiustolls
Chigley	Fine, mixed, thermic Udic Paleustalfs
*Clarita	Fine, montmorillonitic, thermic Udic Pellusterts
Dale	Fine-silty, mixed, thermic Pachic Haplustolls
Darnell	Loamy, siliceous, thermic, shallow Udic Ustochrepts
Darnell Variant	Loamy-skeletal, siliceous, thermic, shallow Udic Ustochrepts
Duffau	Fine-loamy, siliceous, thermic Udic Paleustalfs
Durant	Fine, montmorillonitic, thermic Vertic Argiustolls
Elandco	Fine-silty, mixed, thermic Cumulic Haplustolls
Eufaula	Sandy, siliceous, thermic Psammentic Paleustalfs
Grainola	Fine, mixed, thermic Vertic Haplustalfs
Healdton	Fine, mixed, thermic Typic Natraqualfs
Heiden	Fine, montmorillonitic, thermic Udic Chromusterts
*Kemp	Fine-loamy, mixed, nonacid, thermic Aquic Udifluvents
Kiti	Loamy-skeletal, mixed, thermic Lithic Haplustolls
*Konawa	Fine-loamy, mixed, thermic Ultic Haplustalfs
Konsil	Fine-loamy, siliceous, thermic Ultic Paleustalfs
Lawton Variant	Fine, mixed, thermic Udic Argiustolls
Miller	Fine, mixed, thermic Vertic Haplustolls
Normangee	Fine, montmorillonitic, thermic Vertic Haplustalfs
Pulaski	Coarse-loamy, mixed, nonacid, thermic Typic Ustifluvents
Renfrow	Fine, mixed, thermic Udertic Paleustolls
Scullin	Fine, mixed, thermic Udic Argiustolls
Steedman	Fine, montmorillonitic, thermic Vertic Haplustalfs
Stephenville	Fine-loamy, siliceous, thermic Ultic Haplustalfs
Tamford	Fine, montmorillonitic, thermic Udic Chromusterts
*Tullahassee	Coarse-loamy, mixed, nonacid, thermic Aquic Udifluvents
Watonga	Fine, montmorillonitic, thermic Udic Pellusterts
Weatherford	Fine-loamy, siliceous, thermic Ultic Haplustalfs
*Weswood	Fine-silty, mixed, thermic Fluventic Ustochrepts
Wilson	Fine, montmorillonitic, thermic Vertic Ochraqualfs
Windthorst	Fine, mixed, thermic Udic Paleustalfs
Woodford	Loamy-skeletal, siliceous, thermic Lithic Haplustolls
Yahola	Coarse-loamy, mixed (calcareous), thermic Typic Ustifluvents
Zaneis	Fine-loamy, mixed, thermic Udic Argiustolls

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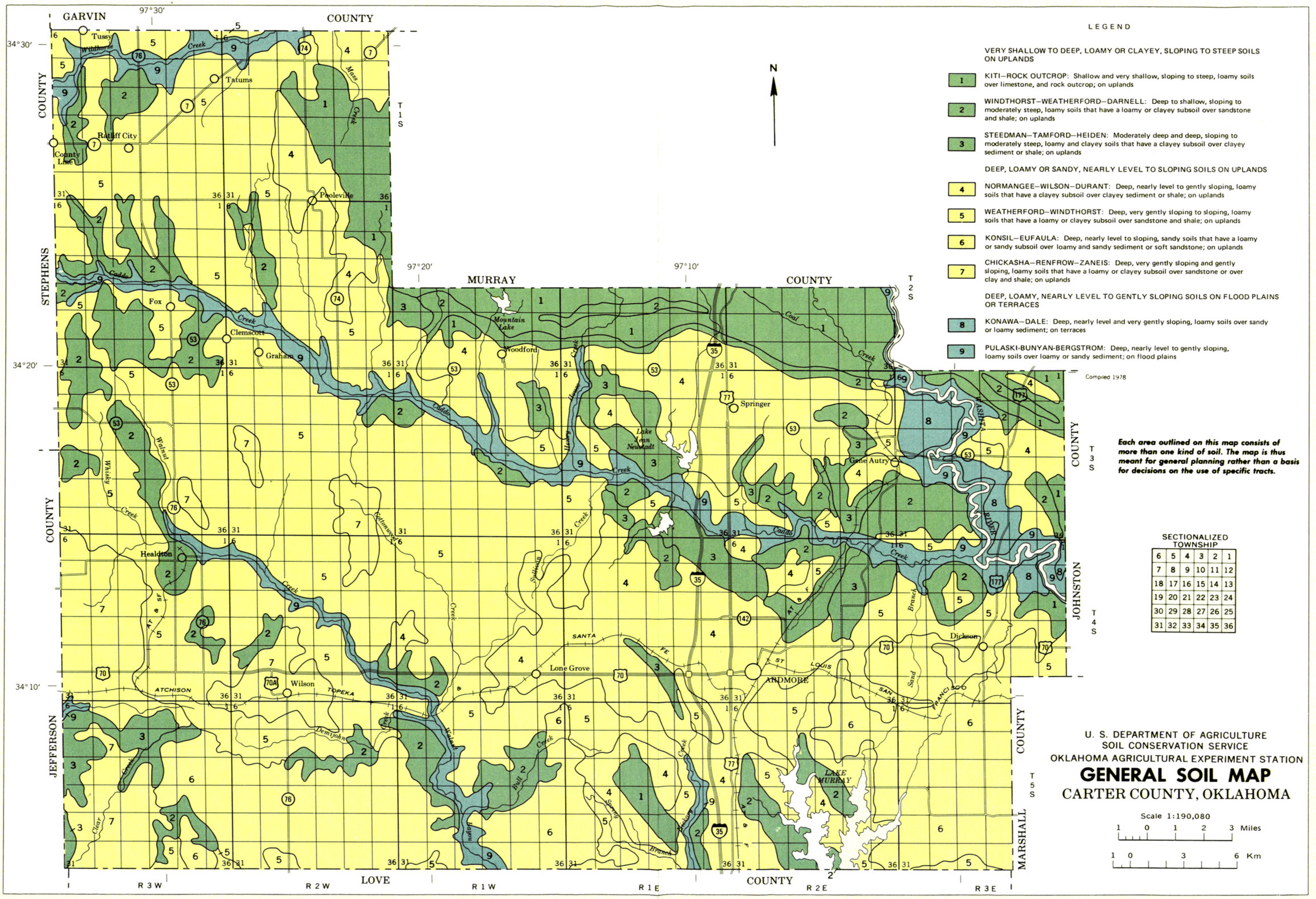
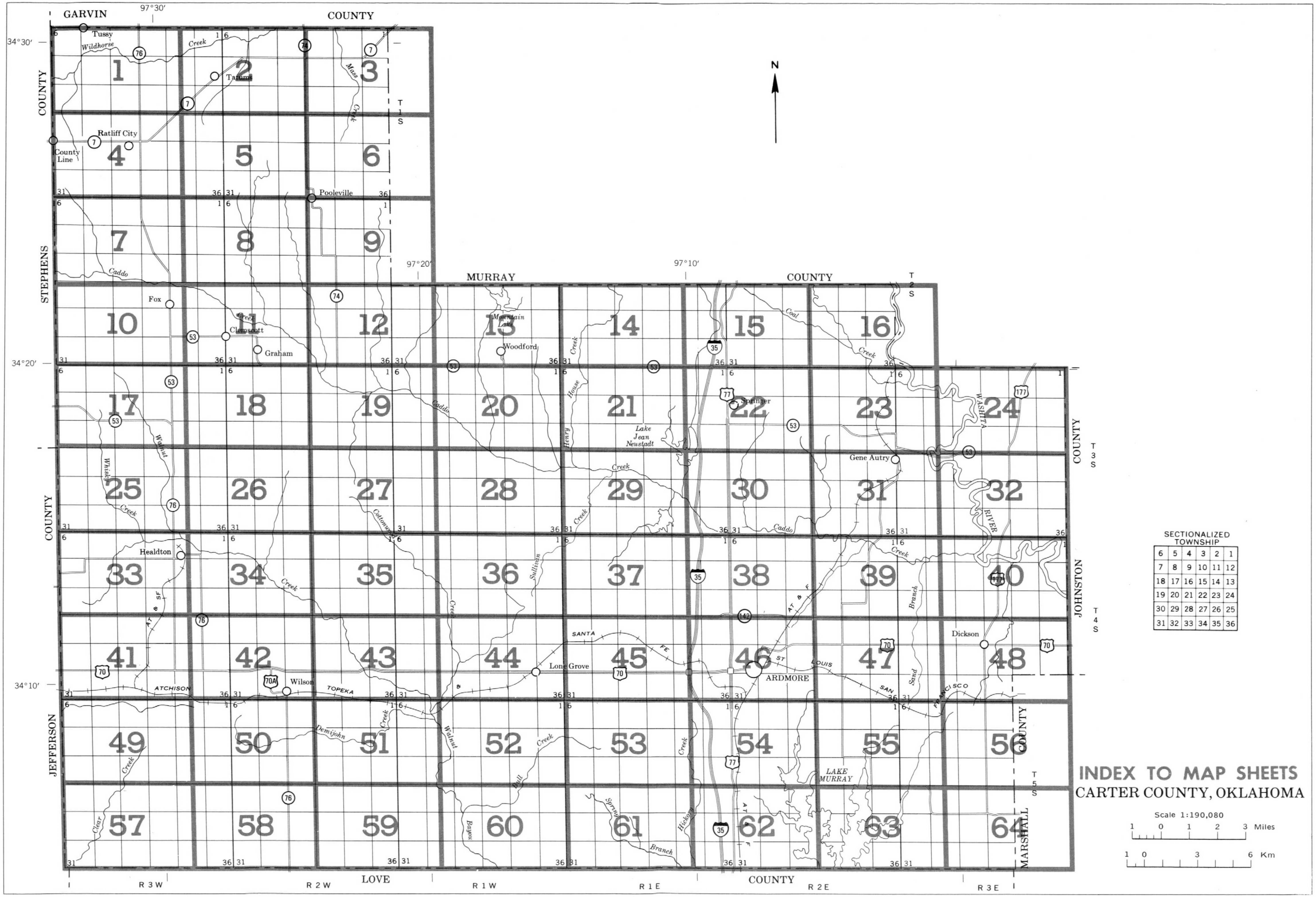

LEGEND
VERY SHALLOW TO DEEP, LOAMY OR CLAYEY, SLOPING TO STEEP SOILS ON UPLANDS
1 KITI–ROCK OUTCROP: Shallow and very shallow, sloping to steep, loamy soils over limestone, and rock outcrop; on uplands
2 WINDTHORST–WEATHERFORD–DARNELL: Deep to shallow, sloping to moderately steep, loamy soils that have a loamy or clayey subsoil over sandstone and shale; on uplands
3 STEEDMAN–TAMFORD–HEIDEN: Moderately deep and deep, sloping to moderately steep, loamy and clayey soils that have a clayey subsoil over clayey sediment or shale; on uplands
DEEP, LOAMY OR SANDY, NEARLY LEVEL TO SLOPING SOILS ON UPLANDS
4 NORMANGEE–WILSON–DURANT: Deep, nearly level to gently sloping, loamy soils that have a clayey subsoil over clayey sediment or shale; on uplands
5 WEATHERFORD–WINDTHORST: Deep, very gently sloping to sloping, loamy soils that have a loamy or clayey subsoil over sandstone and shale; on uplands
6 KONSIL–EUFAULA: Deep, nearly level to sloping, sandy soils that have a loamy or sandy subsoil over loamy and sandy sediment or soft sandstone; on uplands
7 CHICKASHA–RENFROW–ZANEIS: Deep, very gently sloping and gently sloping, loamy soils that have a loamy or clayey subsoil over sandstone or over clay and shale; on uplands
DEEP, LOAMY, NEARLY LEVEL TO GENTLY SLOPING SOILS ON FLOOD PLAINS OR TERRACES
8 KONAWA–DALE: Deep, nearly level and very gently sloping, loamy soils over sandy or loamy sediment; on terraces
9 PULASKI–BUNYAN–BERGSTROM: Deep, nearly level to gently sloping, loamy soils over loamy or sandy sediment; on flood plains
Compiled 1978
Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.
SECTIONALIZED TOWNSHIP
6 5 4 3 2 1
7 8 9 10 11 12
18 17 16 15 14 13
19 20 21 22 23 24
30 29 28 27 26 25
31 32 33 34 35 36
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
OKLAHOMA AGRICULTURAL EXPERIMENT STATION
GENERAL SOIL MAP
CARTER COUNTY, OKLAHOMA
Scale 1:190,080
1 0 1 2 3 Miles
1 0 3 6 Km
N
GARVIN COUNTY
MURRAY COUNTY
STEPHENS COUNTY
JOHNSTON COUNTY
JEFFERSON COUNTY
MARSHALL COUNTY
LOVE COUNTY
97°30′
97°20′
97°10′
34°30′
34°20′
34°10′
T 1 S
T 2 S
T 3 S
T 4 S
T 5 S
R 3 W
R 2 W
R 1 W
R 1 E
R 2 E
R 3 E
Tussy
Tatums
Ratliff City
County Line
Pooleville
Fox
Clemscott
Graham
Woodford
Mountain Lake
Springer
Lake Jean Neustadt
Gene Autry
Healdton
Wilson
Lone Grove
ARDMORE
Dickson
LAKE MURRAY
Wildhorse Creek
Caddo Creek
Mass Creek
Walnut Creek
Whisky Creek
Cottonwood Creek
Hickory Creek
Sulphur Creek
Coal Creek
Demijohn Creek
Bull Creek
Bayou
Spring Branch
Sand Branch
Clear Creek
WASHITA RIVER
ATCHISON TOPEKA
SANTA FE
ST LOUIS SAN FRANCISCO
AT & SF



INDEX TO MAP SHEETS
CARTER COUNTY, OKLAHOMA

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (79)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water; w)

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; w)
- Intermittent (int; i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (CeA; FoB2)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

SOIL LEGEND

SYMBOL	NAME
1	Bergstrom silt loam
2	Bergstrom silty clay loam
3	Bunyan loam
4	Burleson clay, 0 to 1 percent slopes
5	Chickasha loam, 1 to 3 percent slopes
6	Chickasha loam, 3 to 5 percent slopes
7	Chickasha loam, 2 to 5 percent slopes, eroded
8	Chigley-Darnell Variant complex, 10 to 30 percent slopes
9	Clarita silty clay, 3 to 5 percent slopes
10	Dale silt loam
11	Durant loam, 1 to 3 percent slopes
12	Durant loam, 3 to 5 percent slopes
13	Elandco clay loam
14	Eufaula fine sand, 5 to 15 percent slopes
15	Healdton silt loam
16	Heiden clay, 1 to 3 percent slopes
17	Heiden clay, 5 to 12 percent slopes
18	Kemp and Tullahassee soils
19	Kiti-Grainola complex, 5 to 20 percent slopes
20	Kiti-Rock outcrop complex, 5 to 30 percent slopes
21	Konawa fine sandy loam, 0 to 1 percent slopes
22	Konawa fine sandy loam, 1 to 3 percent slopes
23	Konawa fine sandy loam, 8 to 20 percent slopes
24	Konsil loamy fine sand, 0 to 3 percent slopes
25	Konsil loamy fine sand, 3 to 8 percent slopes
26	Konsil and Weatherford soils, gullied
27	Lawton Variant clay loam, 3 to 5 percent slopes
28	Miller silt clay
29	Miller soils
30	Normangee loam, 2 to 5 percent slopes
31	Normangee loam, 2 to 5 percent slopes, eroded
32	Normangee clay loam, 2 to 5 percent slopes, severely eroded
33	Oil-Waste land
34	Pits
35	Pulaski fine sandy loam
36	Pulaski and Bunyan soils
37	Renfrow silt loam, 1 to 3 percent slopes
38	Renfrow silt loam, 3 to 5 percent slopes
39	Scullin-Kiti complex, 1 to 8 percent slopes
40	Steedman clay loam, 5 to 20 percent slopes
41	Stephenville-Darnell complex, 2 to 8 percent slopes
42	Tamford-Grainola complex, 5 to 12 percent slopes
43	Watonga silty clay
44	Weatherford fine sandy loam, 1 to 3 percent slopes
45	Weatherford fine sandy loam, 3 to 5 percent slopes
46	Weatherford fine sandy loam, 2 to 5 percent slopes, eroded
47	Weatherford-Duffau complex, 3 to 8 percent slopes
48	Weswood silt loam
49	Wilson silt loam, 0 to 1 percent slopes
50	Wilson silt loam, 1 to 3 percent slopes
51	Windthorst fine sandy loam, 1 to 3 percent slopes
52	Windthorst fine sandy loam, 3 to 5 percent slopes
53	Windthorst fine sandy loam, 2 to 5 percent slopes, eroded
54	Windthorst-Darnell complex, 5 to 20 percent slopes
55	Windthorst-Weatherford complex, 5 to 12 percent slopes
56	Woodford silt loam, 5 to 20 percent slopes
57	Yahola soils
58	Zaneis loam, 3 to 5 percent slopes

CARTER COUNTY, OKLAHOMA — SHEET NUMBER 1

CARTER COUNTY, OKLAHOMA NO. 1

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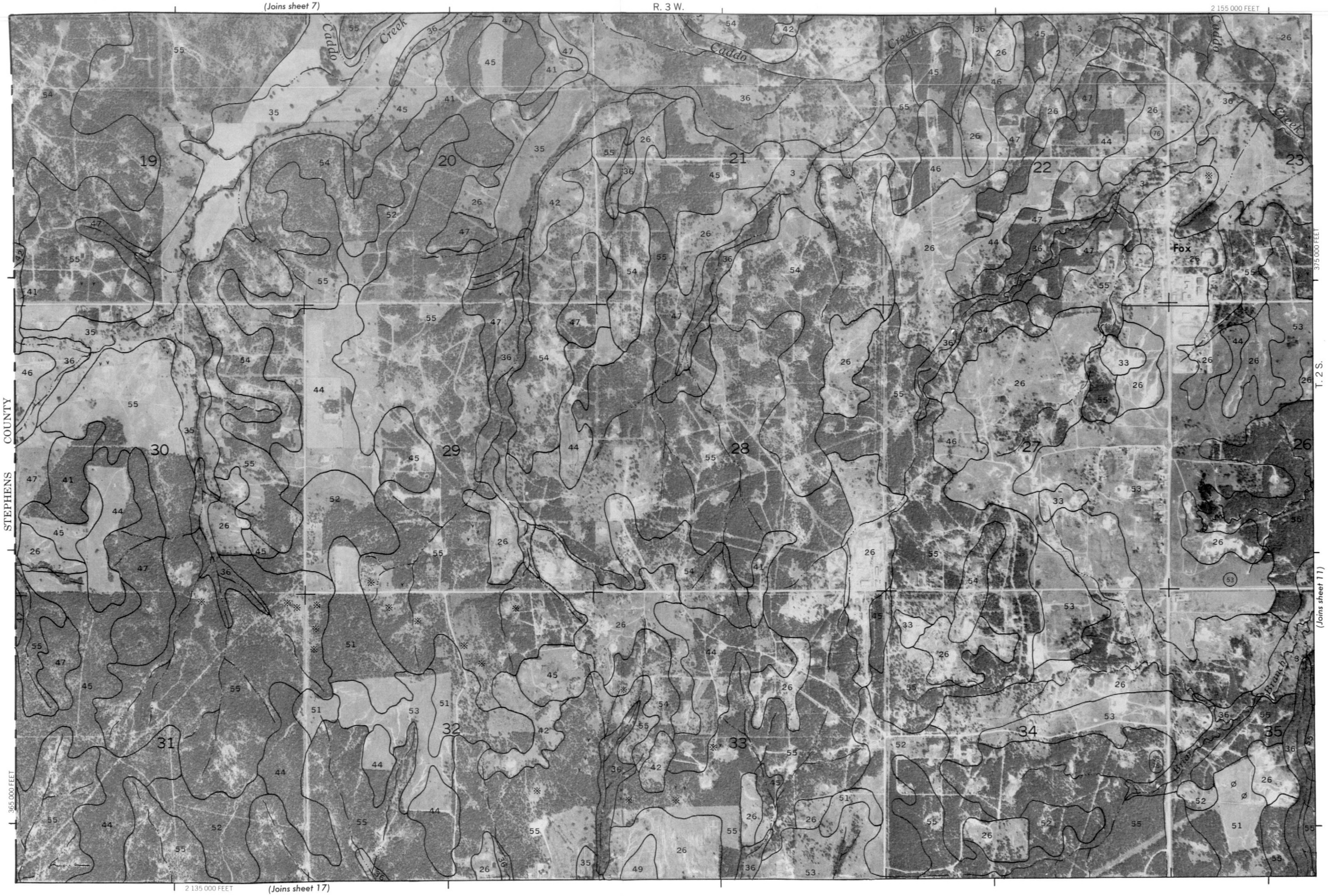
N



Scale 1:20000
1 Mile
5000 Feet
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

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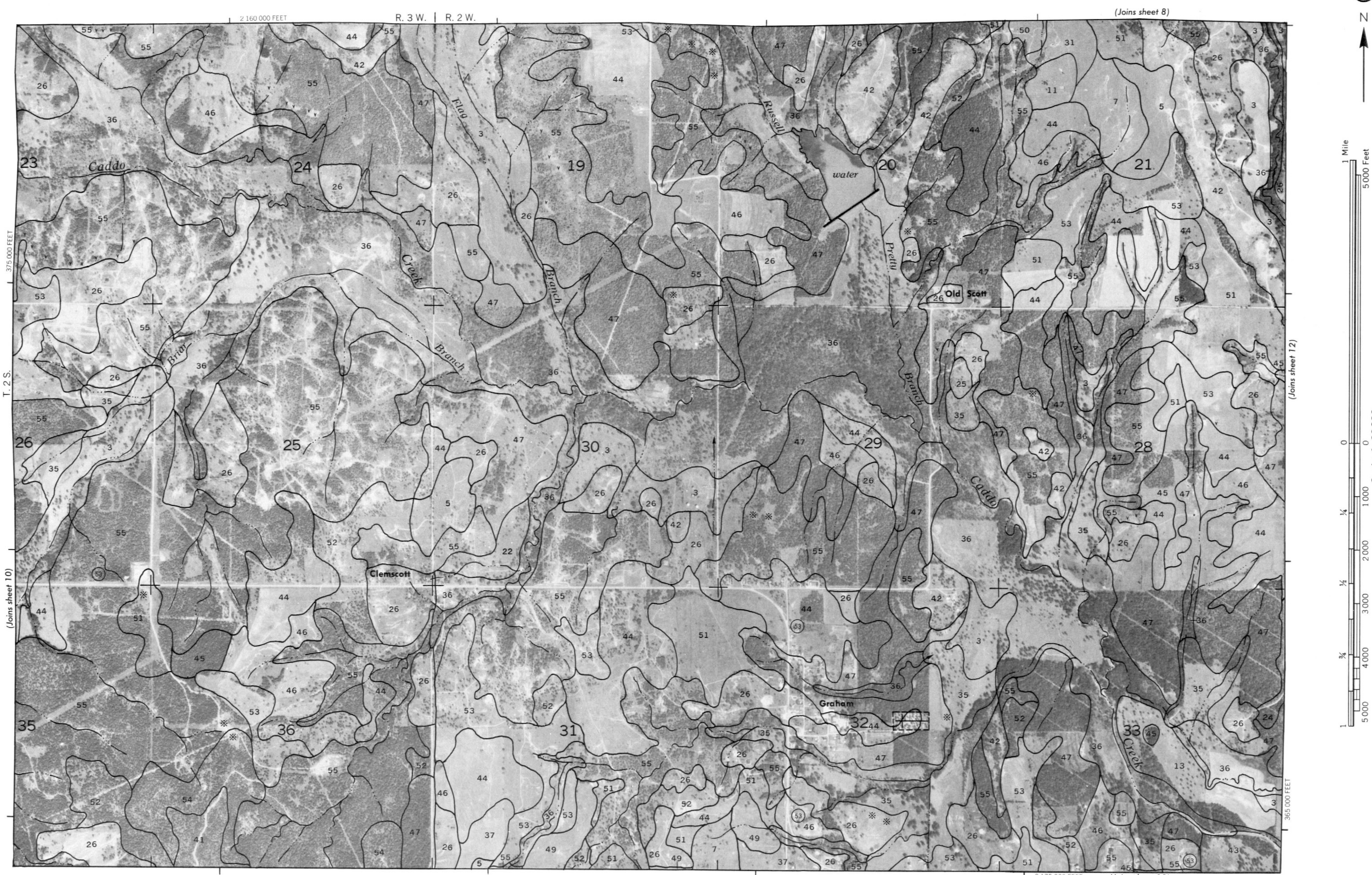

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CARTER COUNTY, OKLAHOMA — SHEET NUMBER 12

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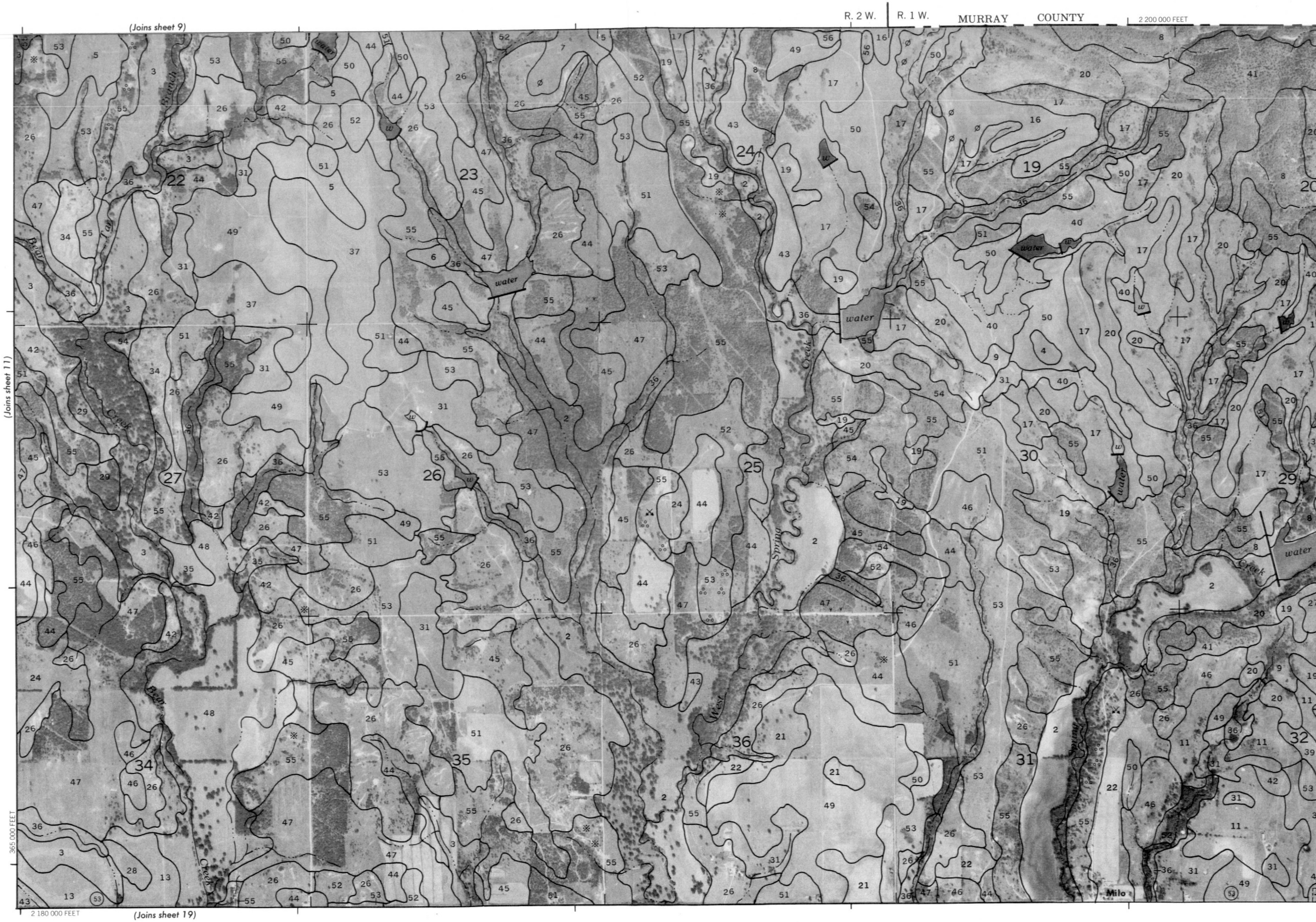

Scale 1:20000

1 Mile | ¾ | ½ | ¼ | 0

5000 Feet | 4000 | 3000 | 2000 | 1000 | 0

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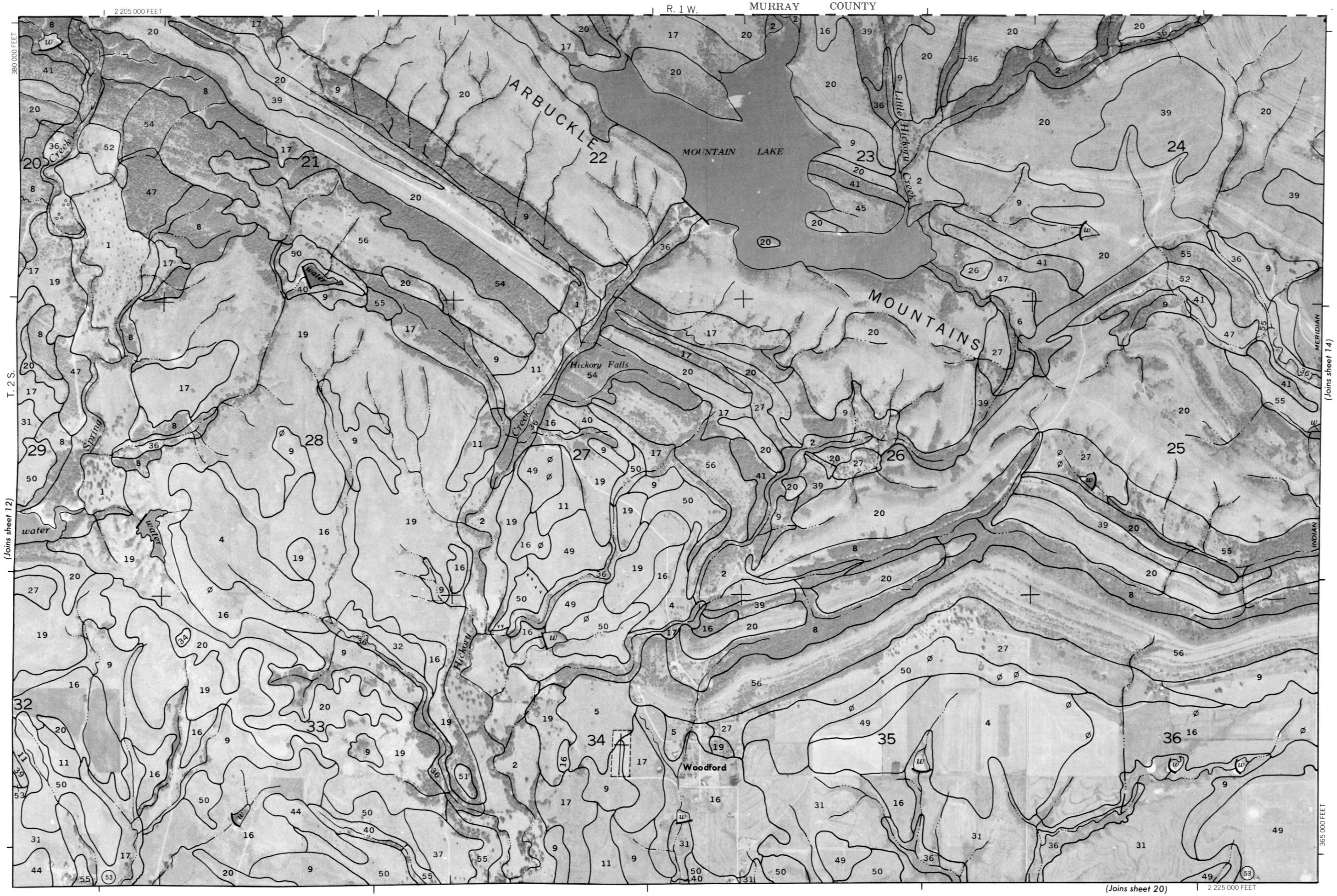

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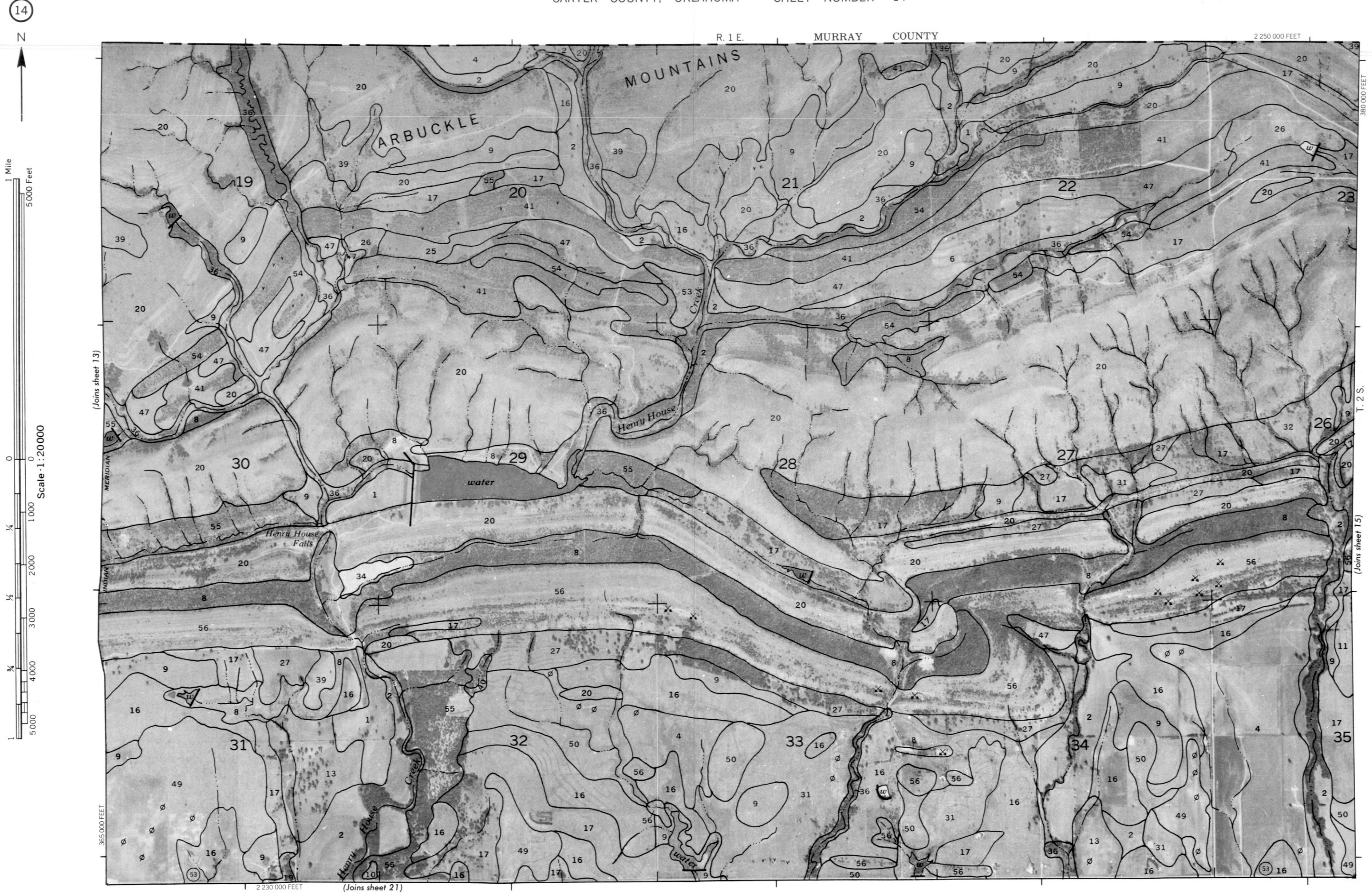
N

1 Mile
5000 Feet

Scale 1:20000



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CARTER COUNTY, OKLAHOMA NO. 14

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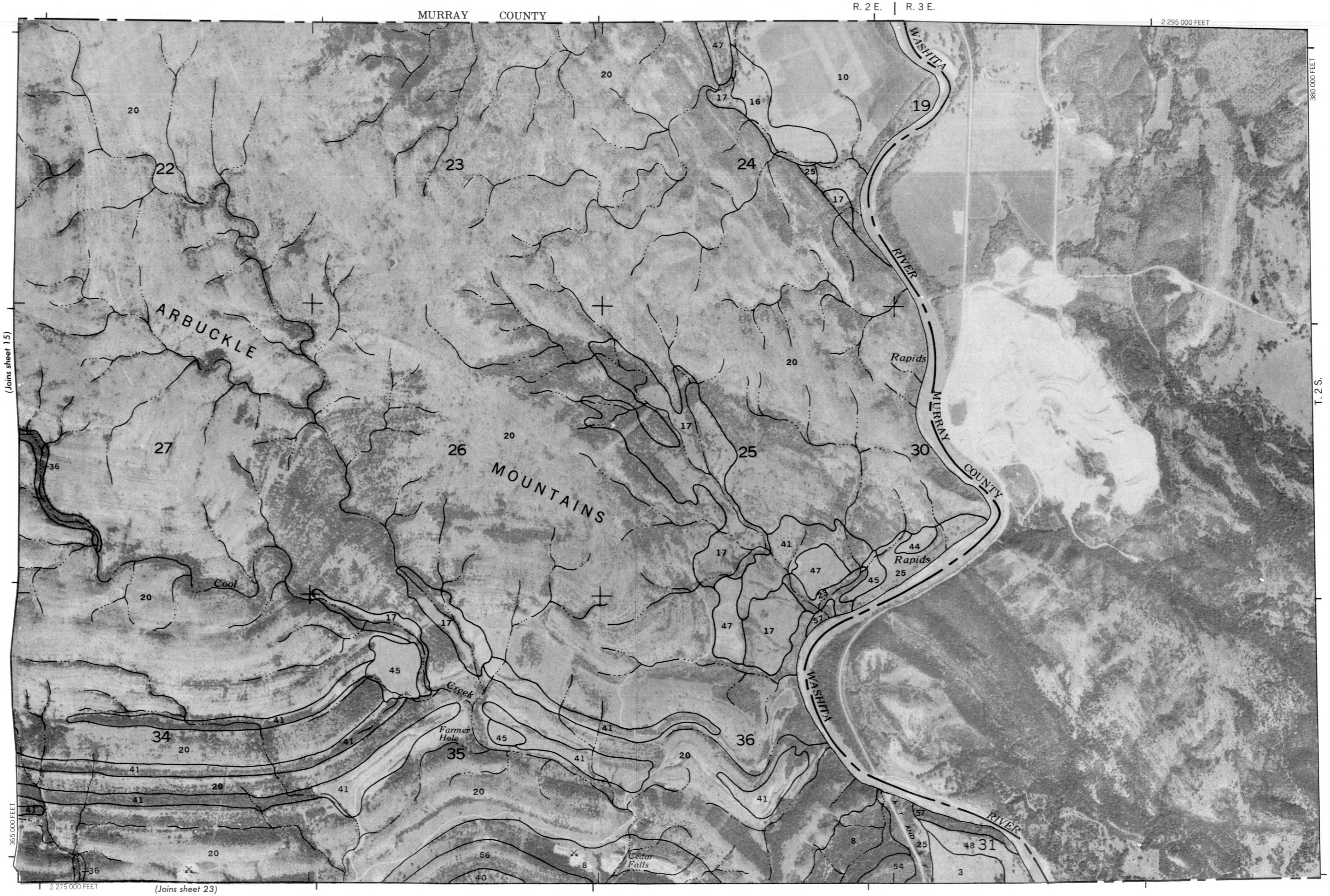
N

Scale 1:20000



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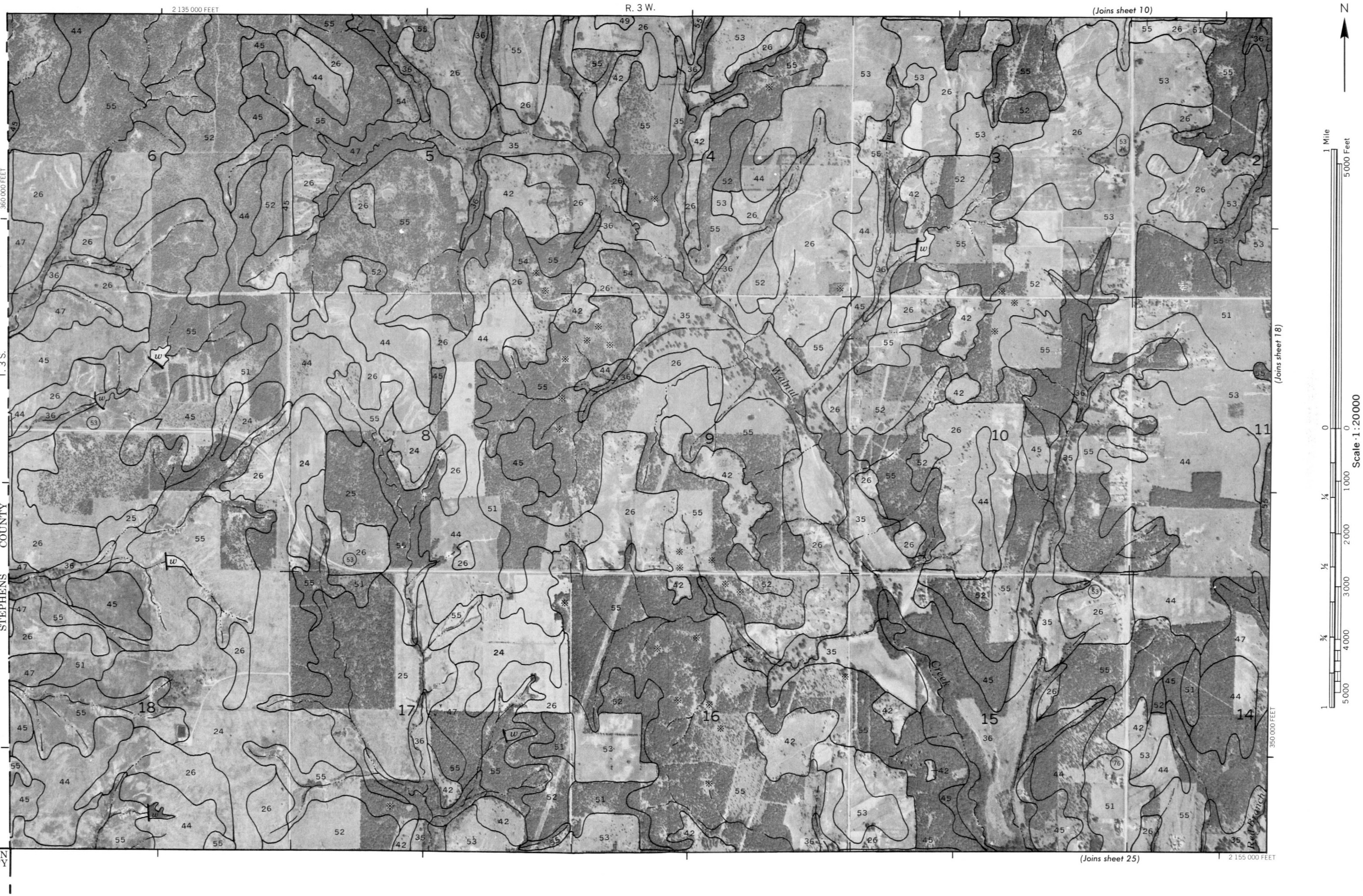

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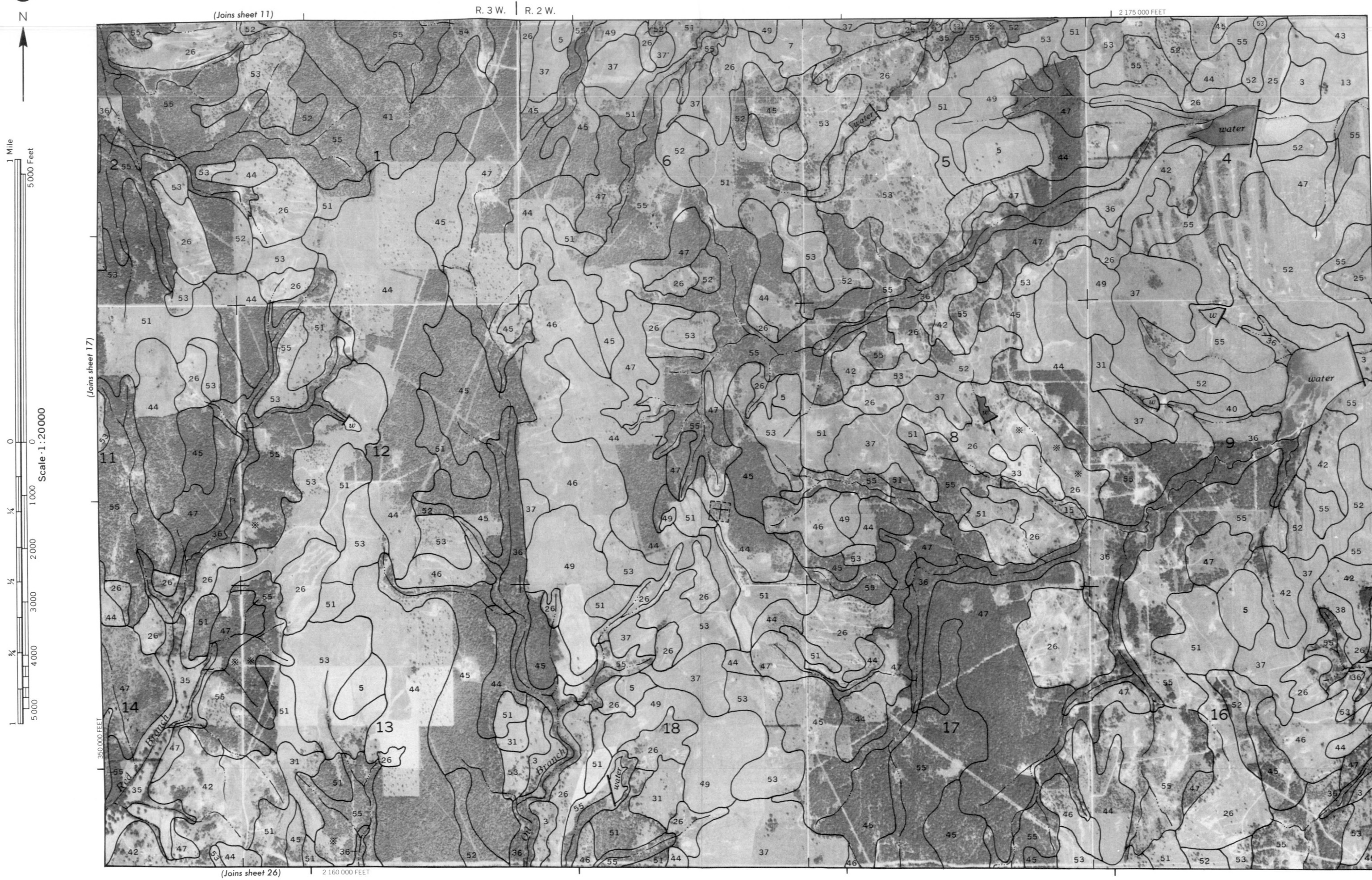

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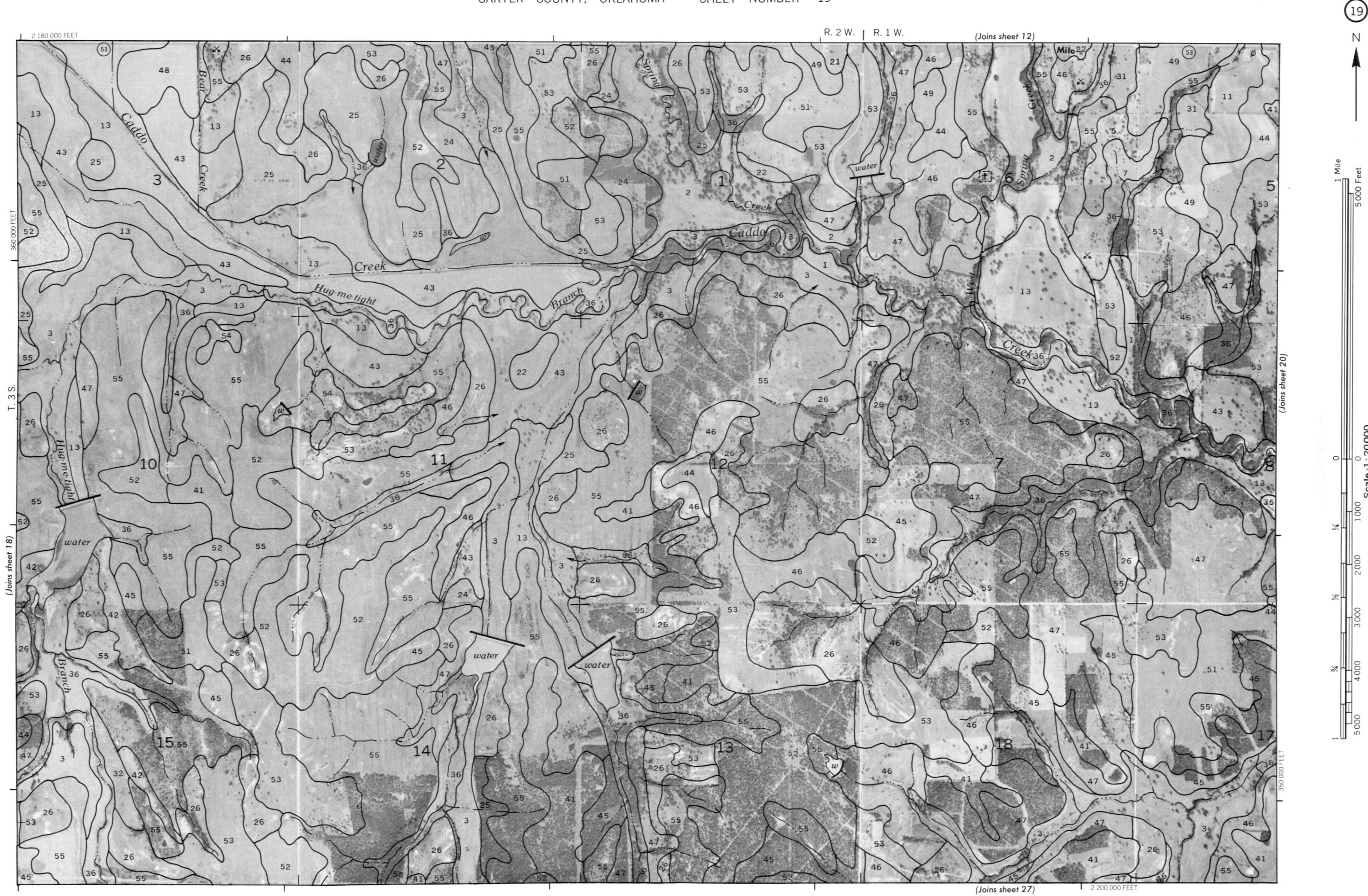

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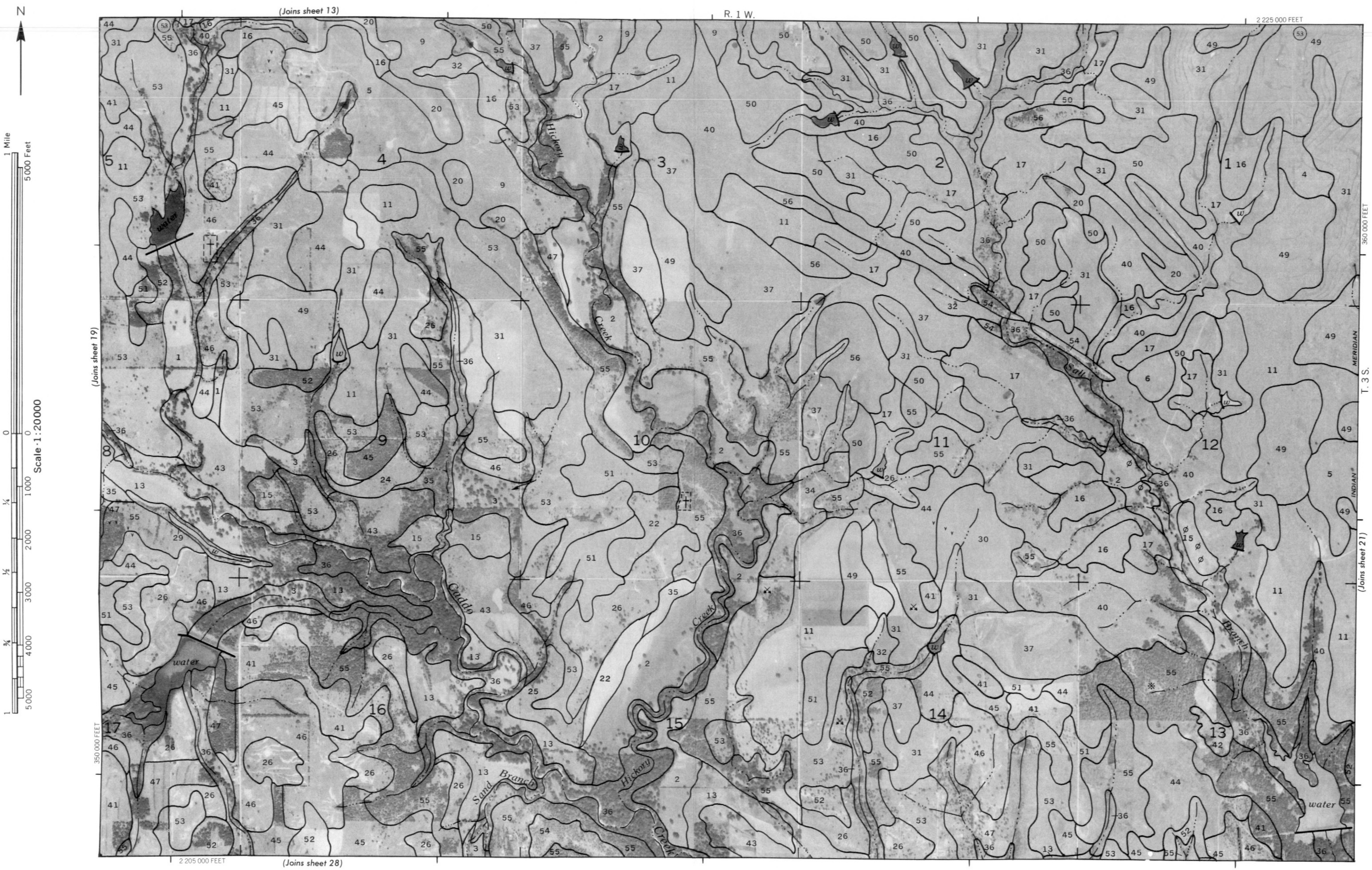
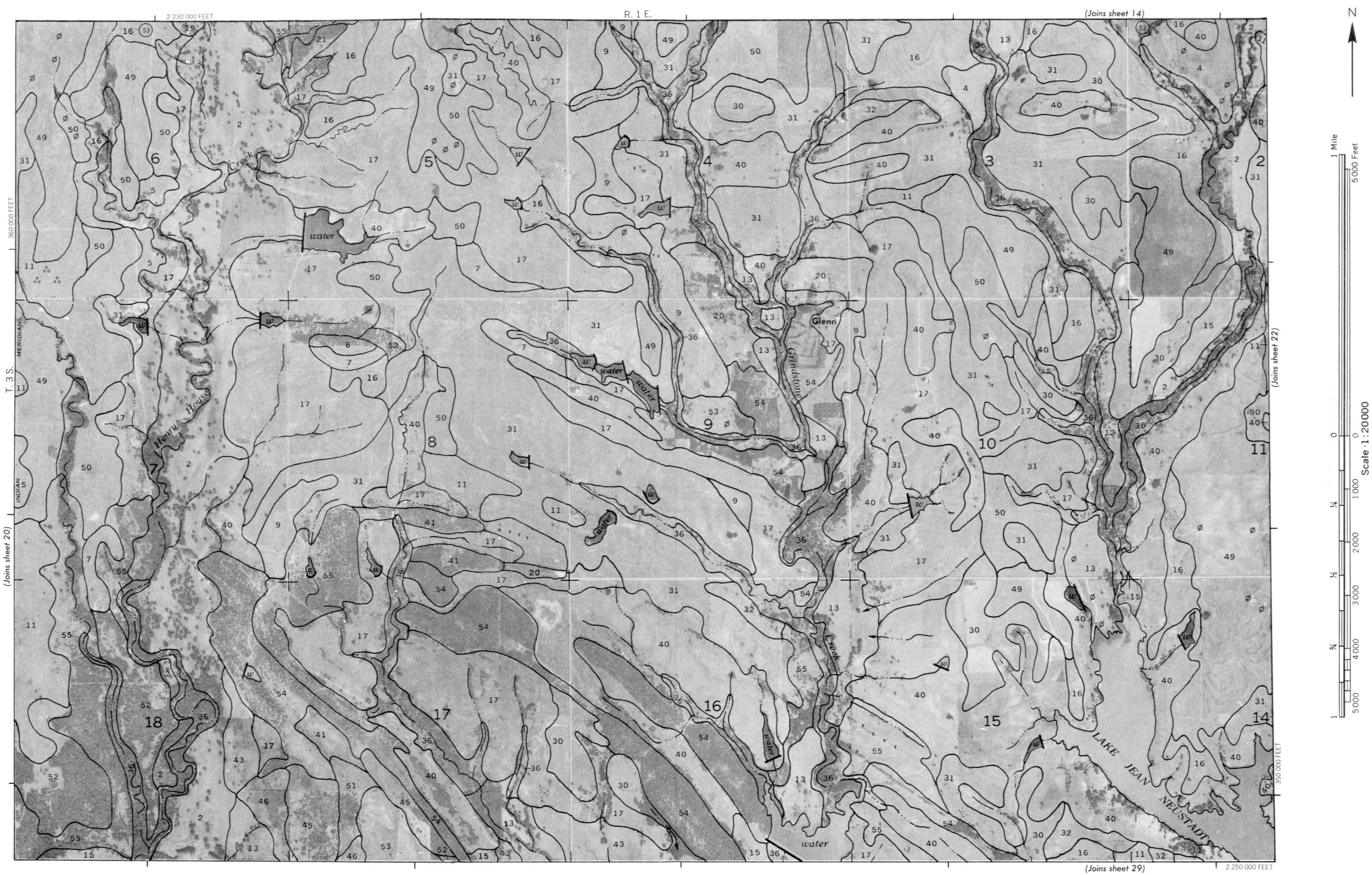
CARTER COUNTY, OKLAHOMA NO. 2



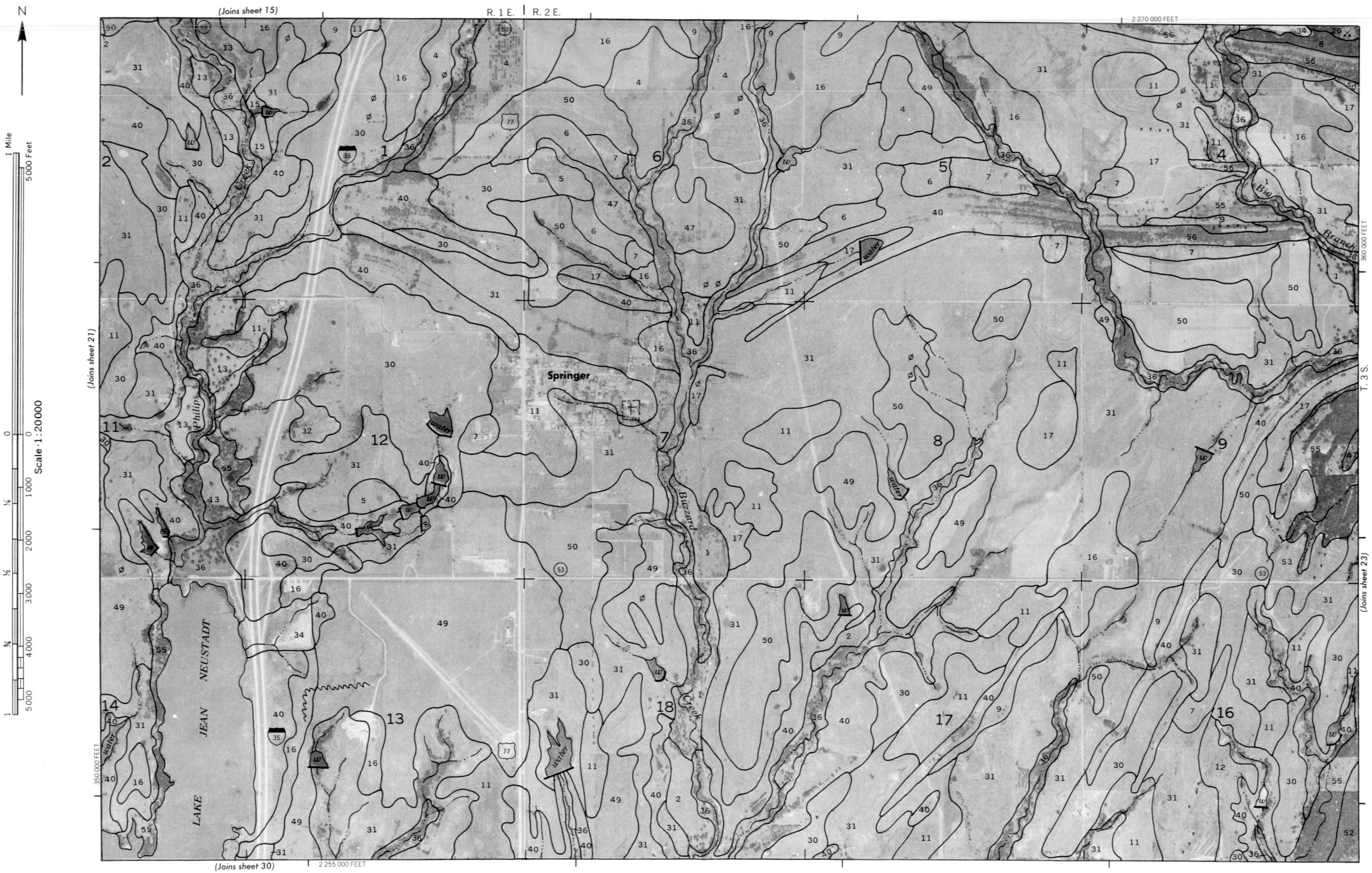
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARTER COUNTY, OKLAHOMA NO. 20



CARTER COUNTY, OKLAHOMA NO. 21
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARTER COUNTY, OKLAHOMA — SHEET NUMBER 22



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARTER COUNTY, OKLAHOMA NO. 22

(23)

CARTER COUNTY, OKLAHOMA NO. 23

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

24

N

Scale 1:20000

1 Mile

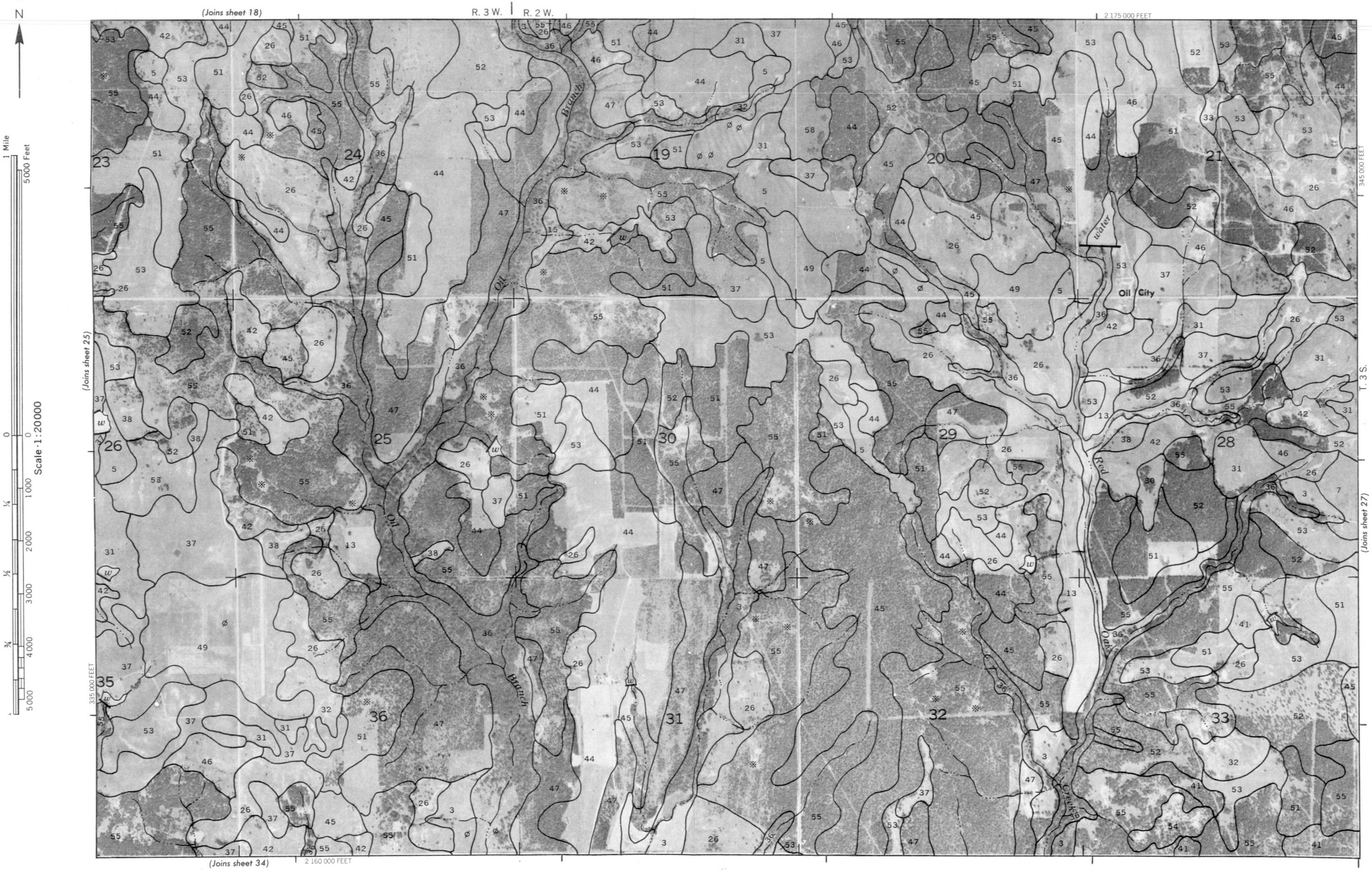
5000 Feet

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARTER COUNTY, OKLAHOMA NO. 24

CARTER COUNTY, OKLAHOMA NO. 25

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARTER COUNTY, OKLAHOMA NO. 26

27

CARTER COUNTY, OKLAHOMA NO. 27

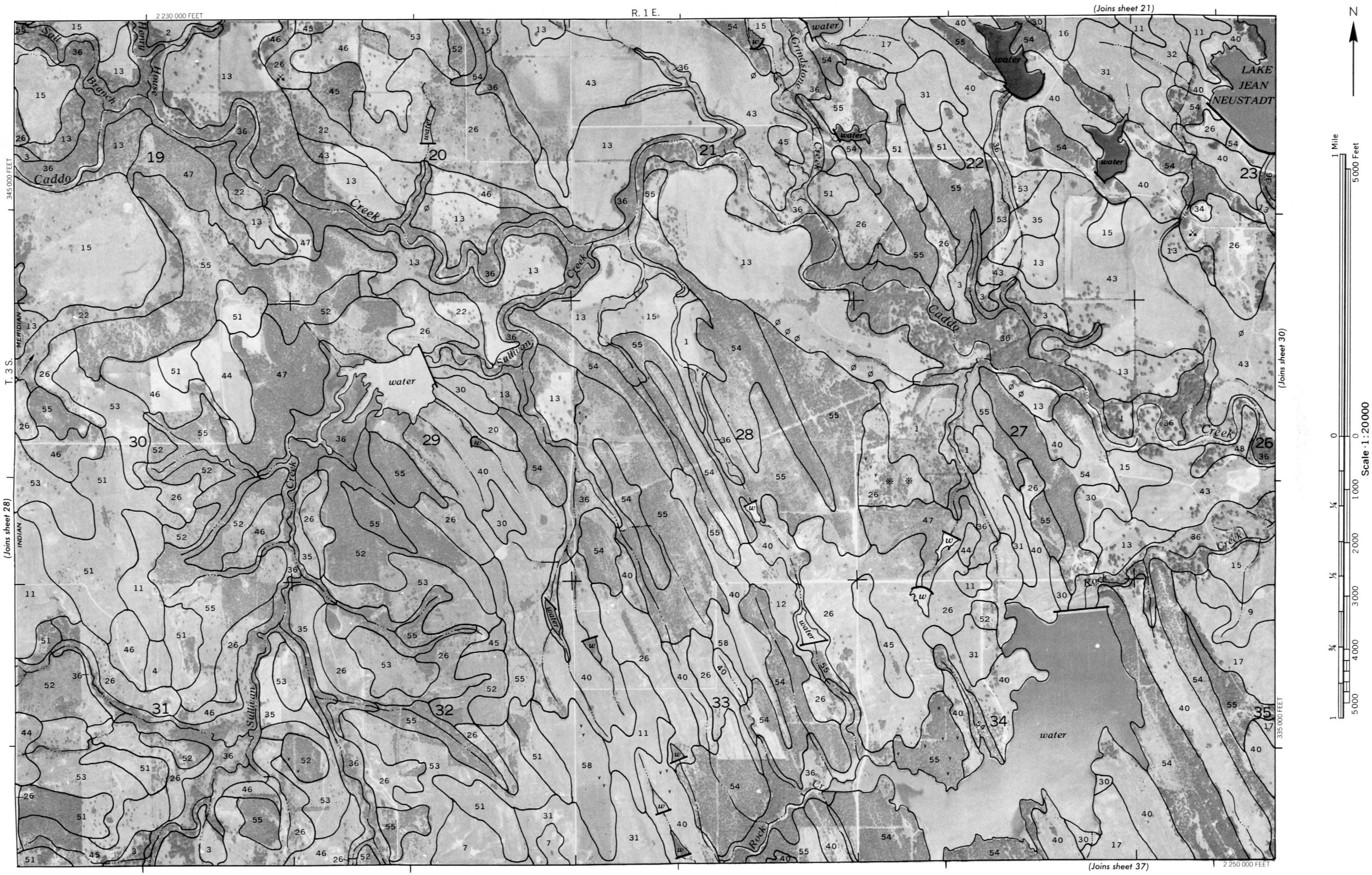
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

1 Mile
5000 Feet
Scale 1:20000

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

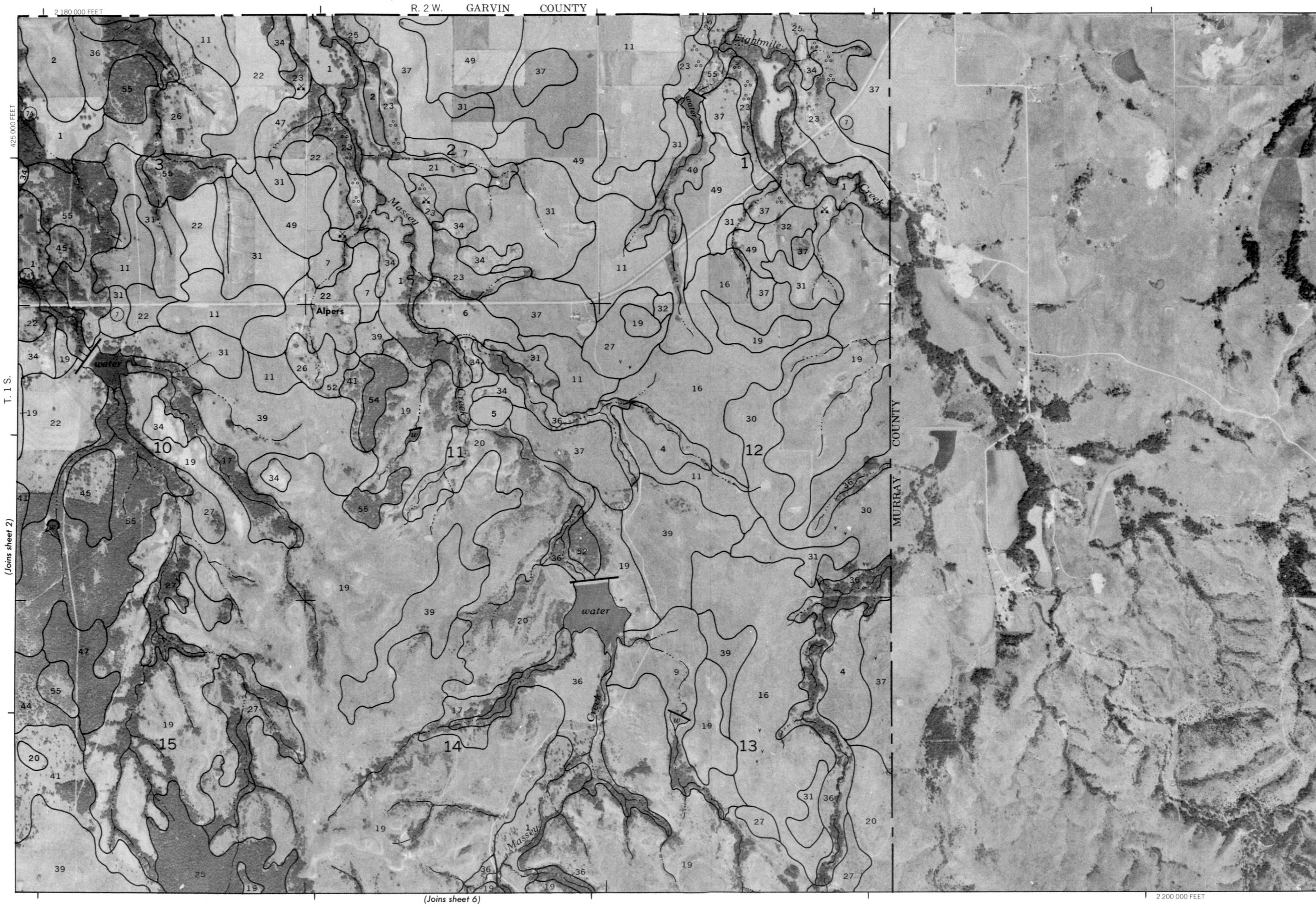
CARTER COUNTY, OKLAHOMA NO. 28



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3

N

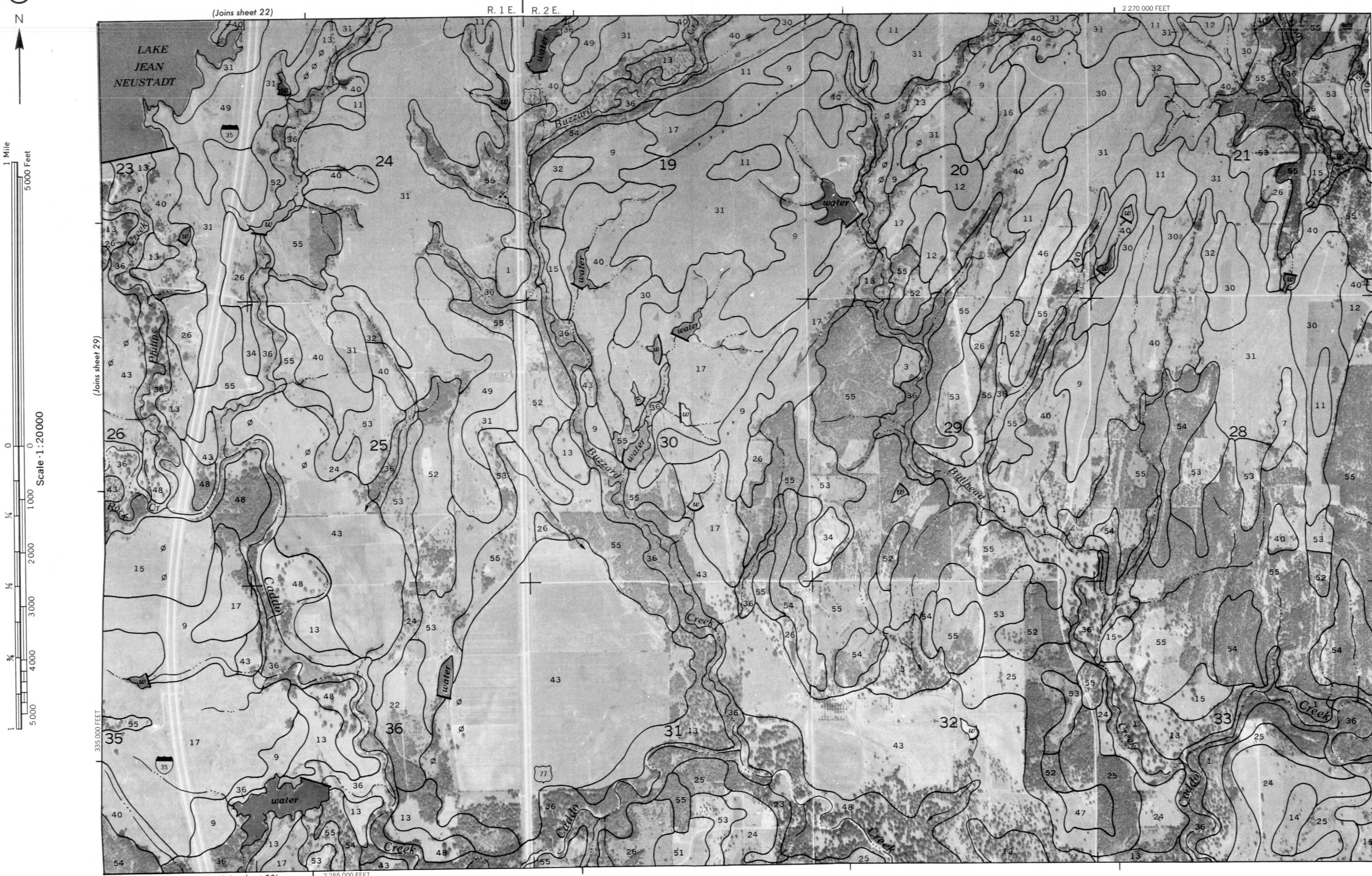


CARTER COUNTY, OKLAHOMA NO. 3

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 Mile — 5000 Feet

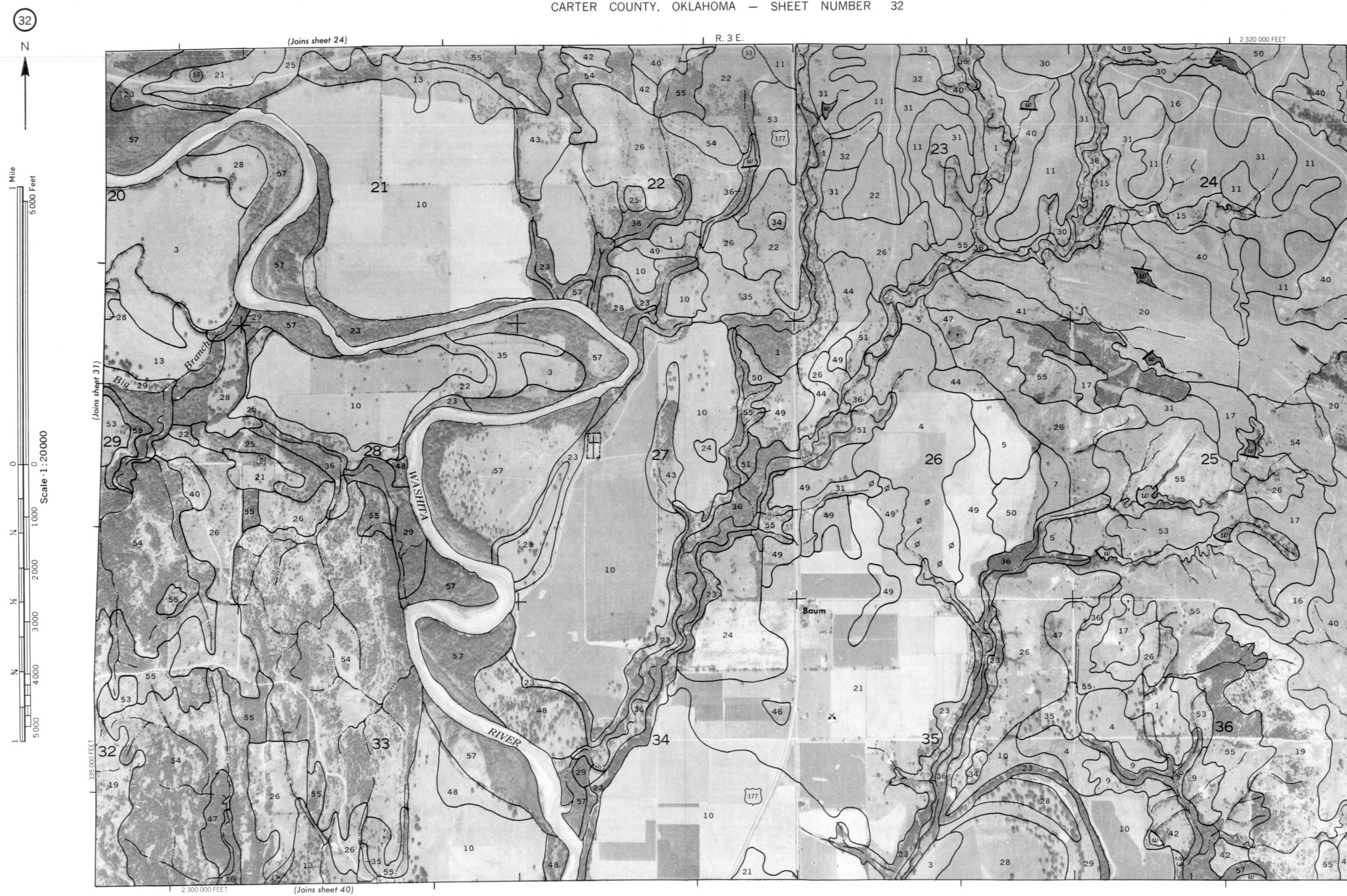
Scale 1:20000



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

31

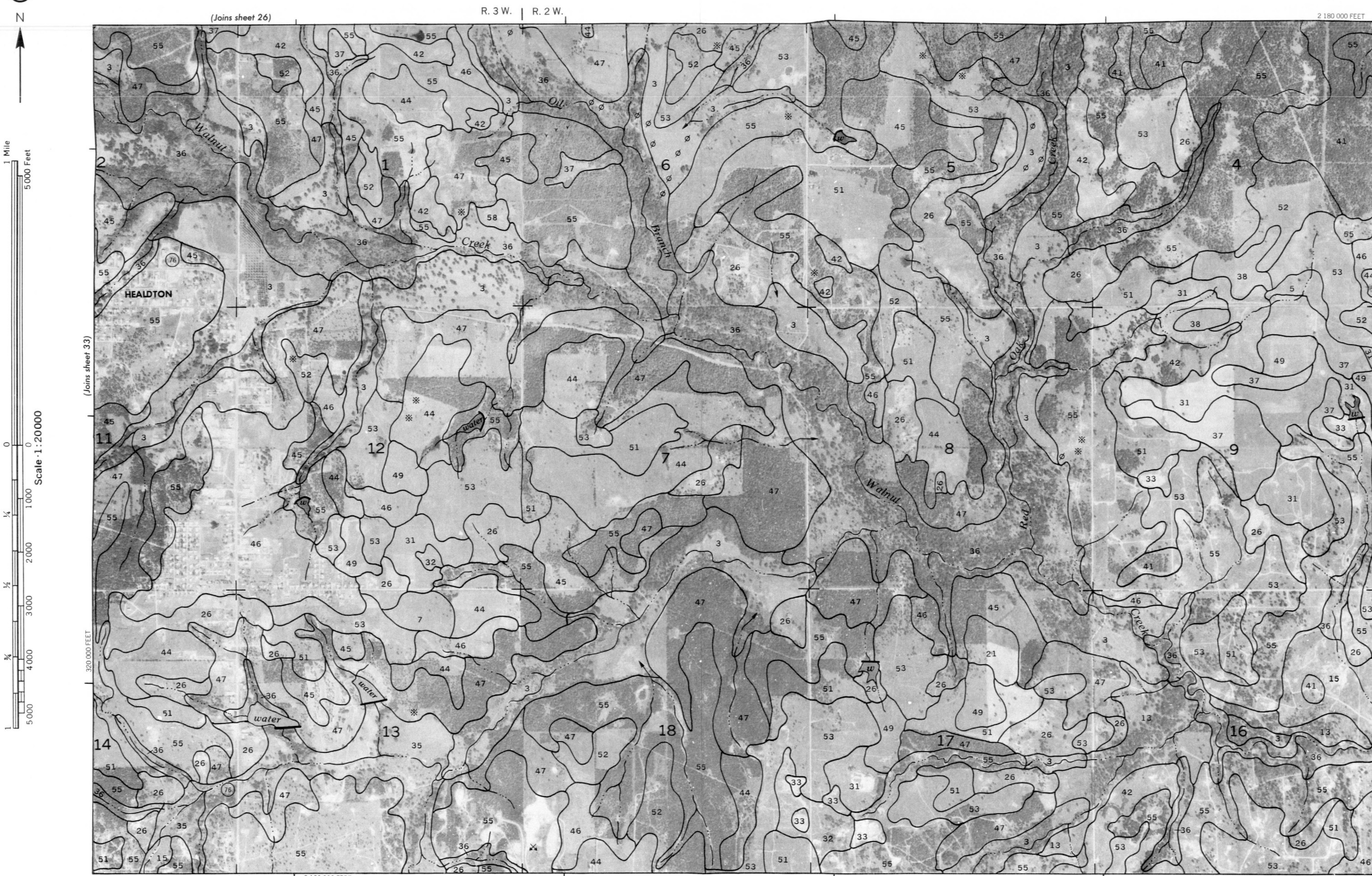
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

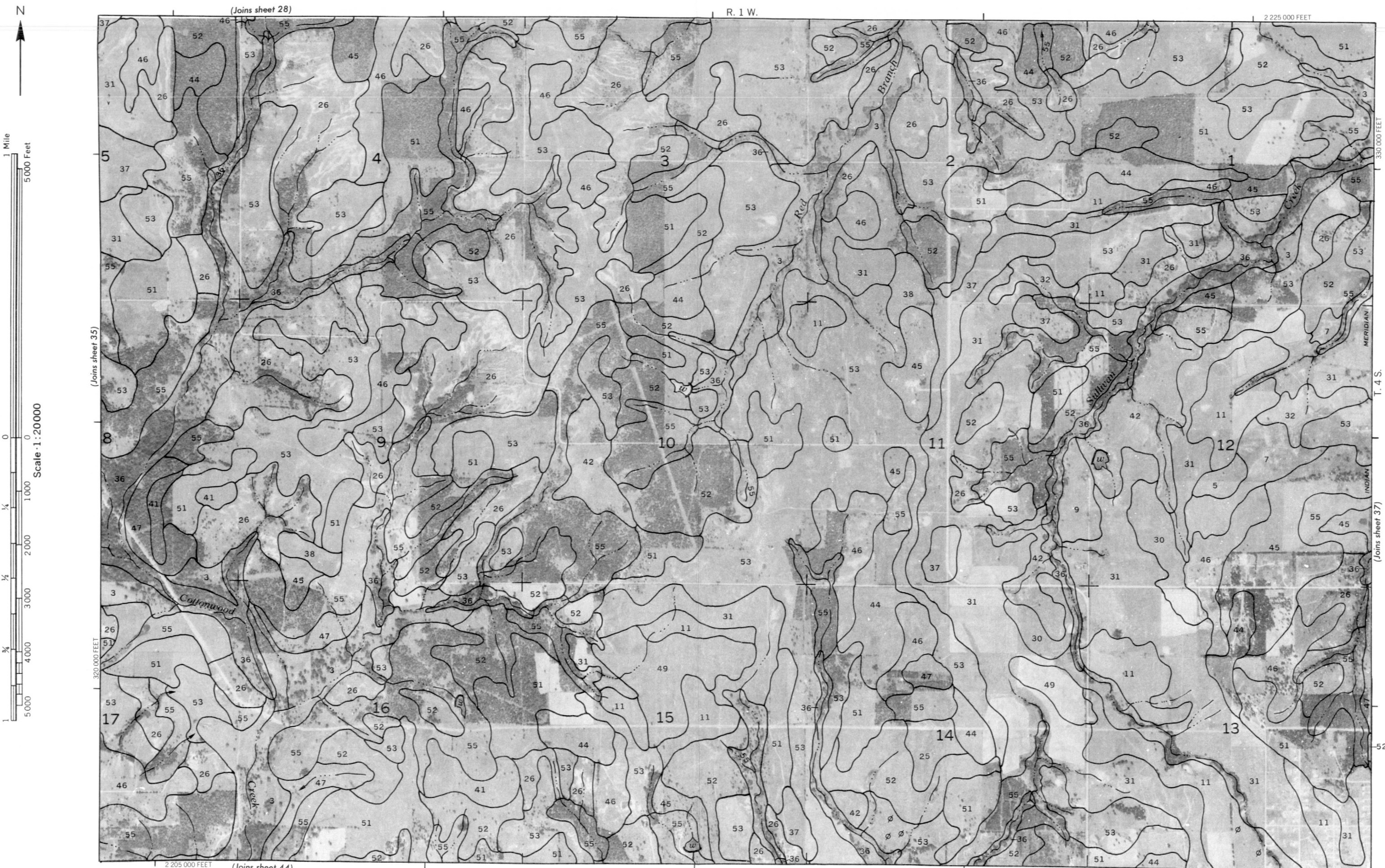
CARTER COUNTY, OKLAHOMA NO. 33

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

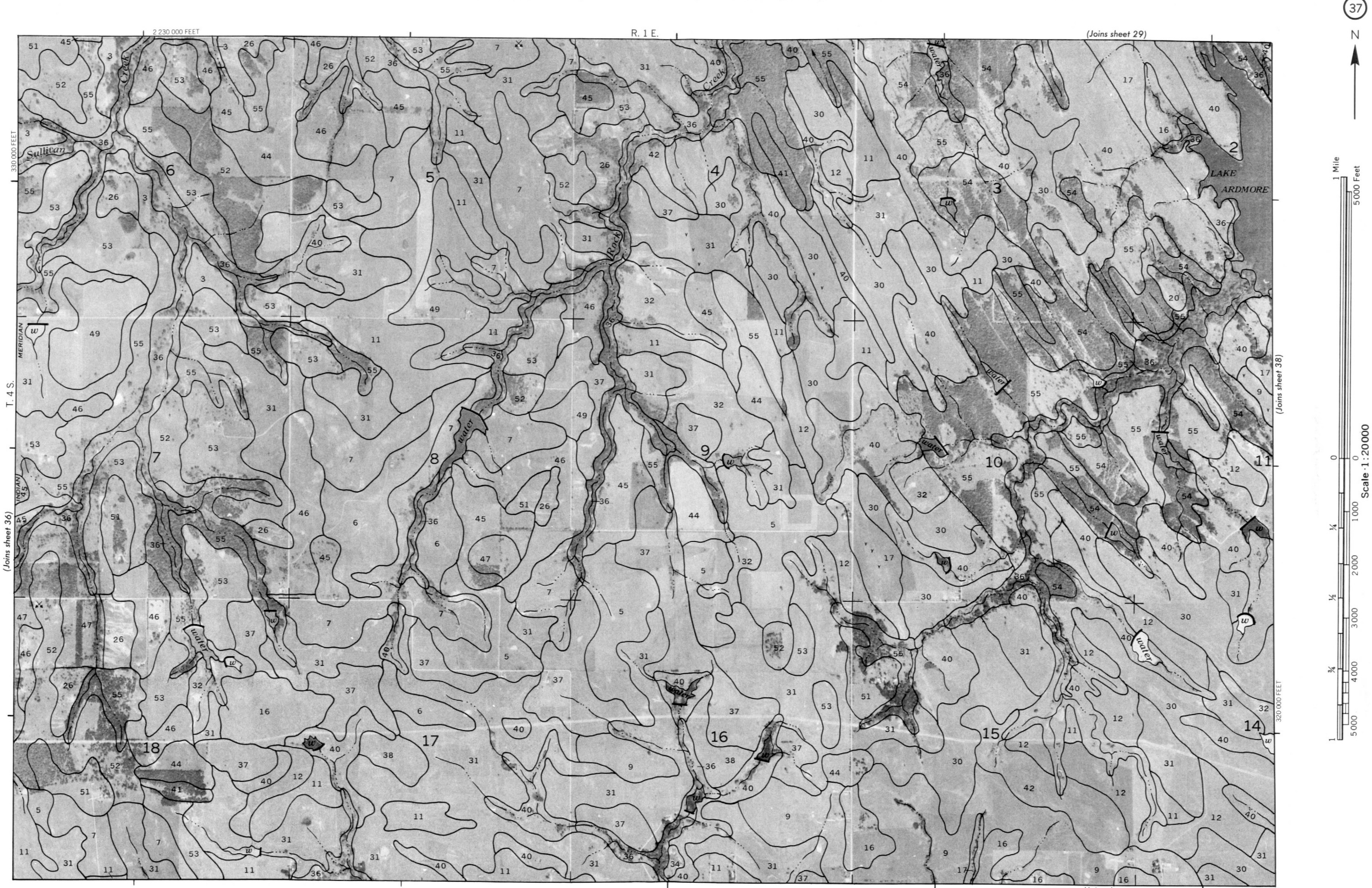


This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

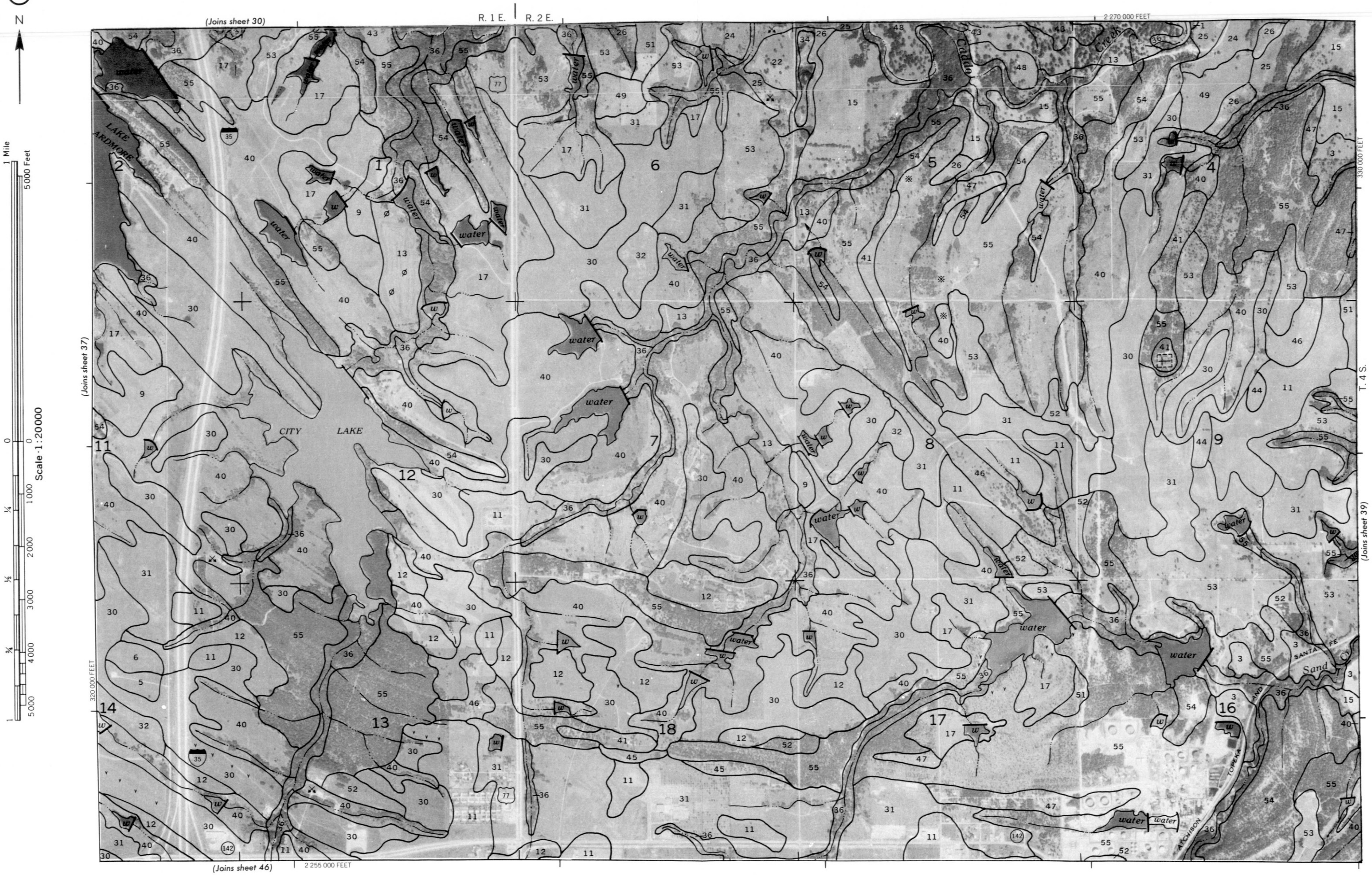
CARTER COUNTY, OKLAHOMA NO. 34



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARTER COUNTY, OKLAHOMA NO. 38


39
N
(Joins sheet 31)
(Joins sheet 38)
(Joins sheet 40)
(Joins sheet 47)
R. 2 E. | R. 3 E.
T. 4 S.
2 275 000 FEET
2 295 000 FEET
330 000 FEET
320 000 FEET
Caddo Creek
Sand Creek
Sand Branch
SANTA FE
ATCHISON TOPEKA AND
CHICKASAW LAKE
water
1 Mile
5000 Feet
Scale 1:20000
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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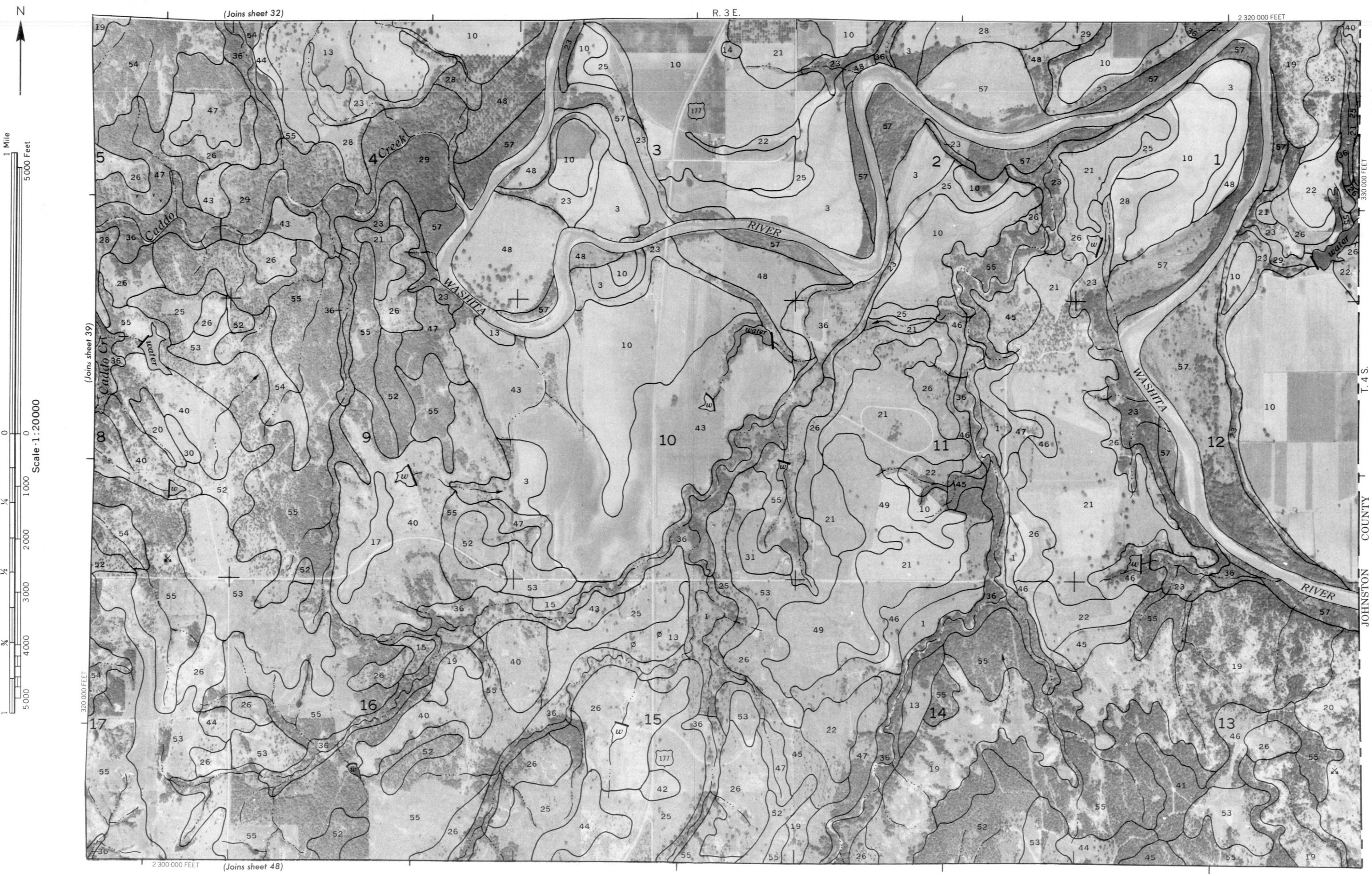
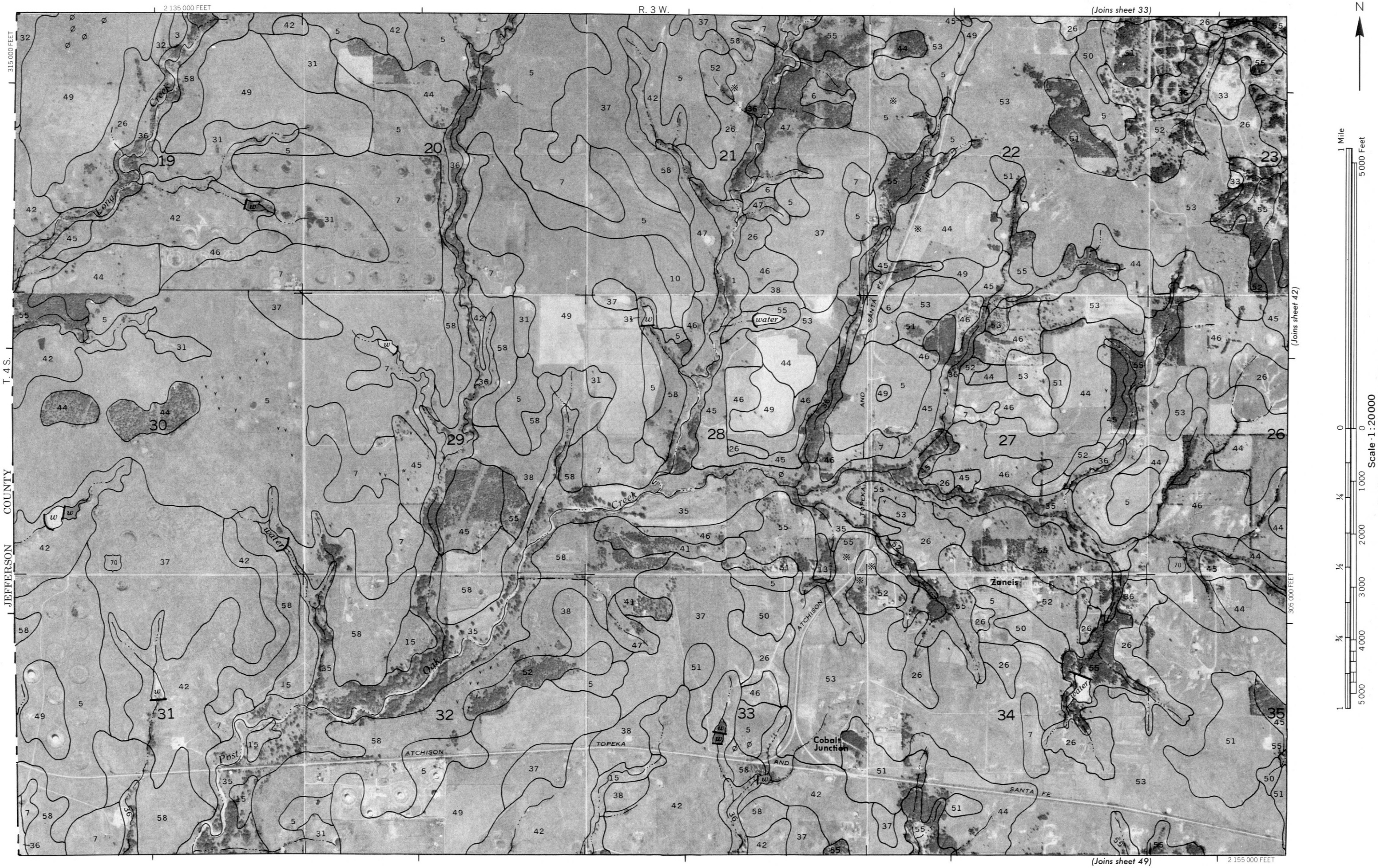
CARTER COUNTY, OKLAHOMA NO. 4

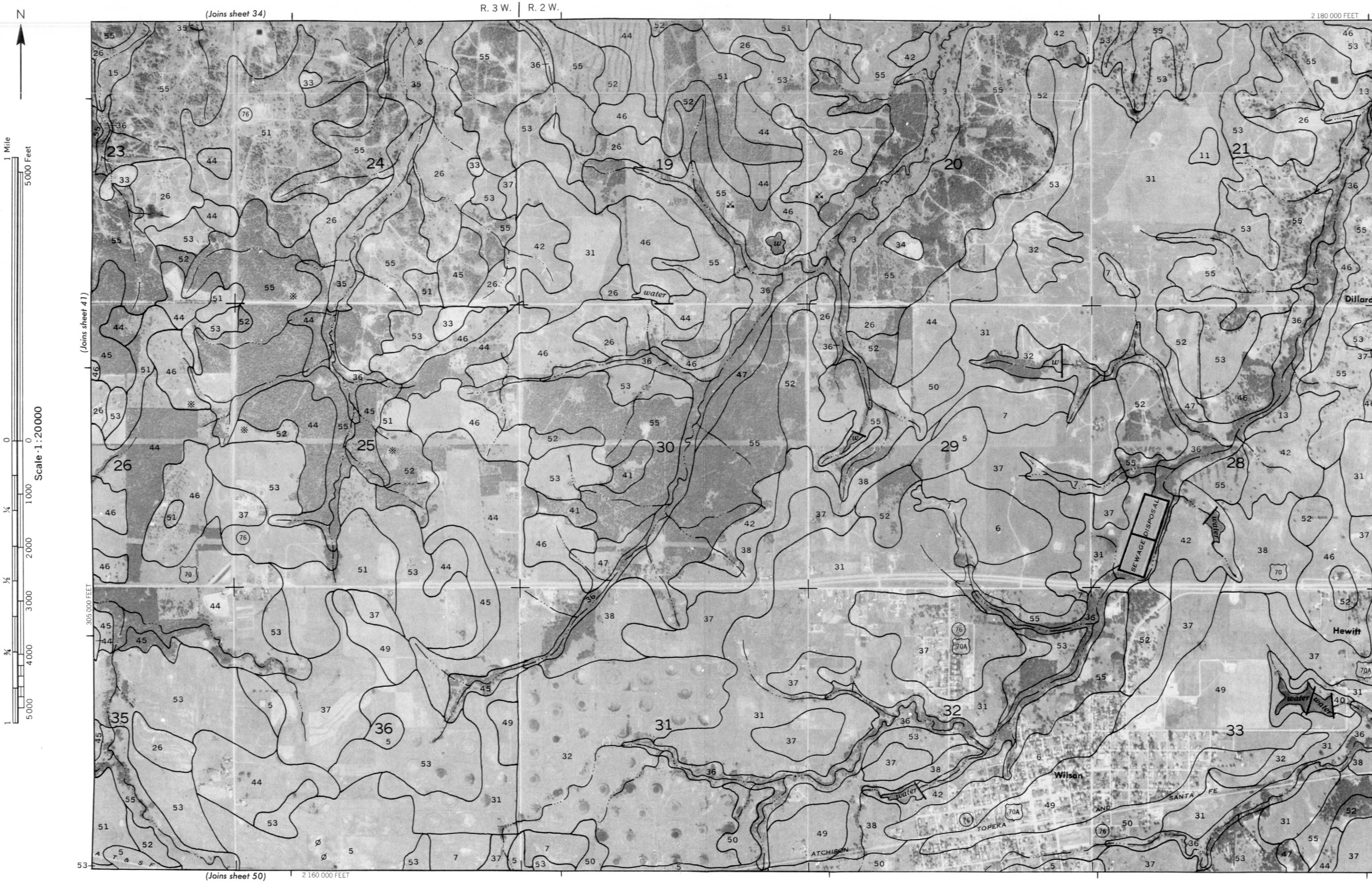
CARTER COUNTY, OKLAHOMA — SHEET NUMBER 40



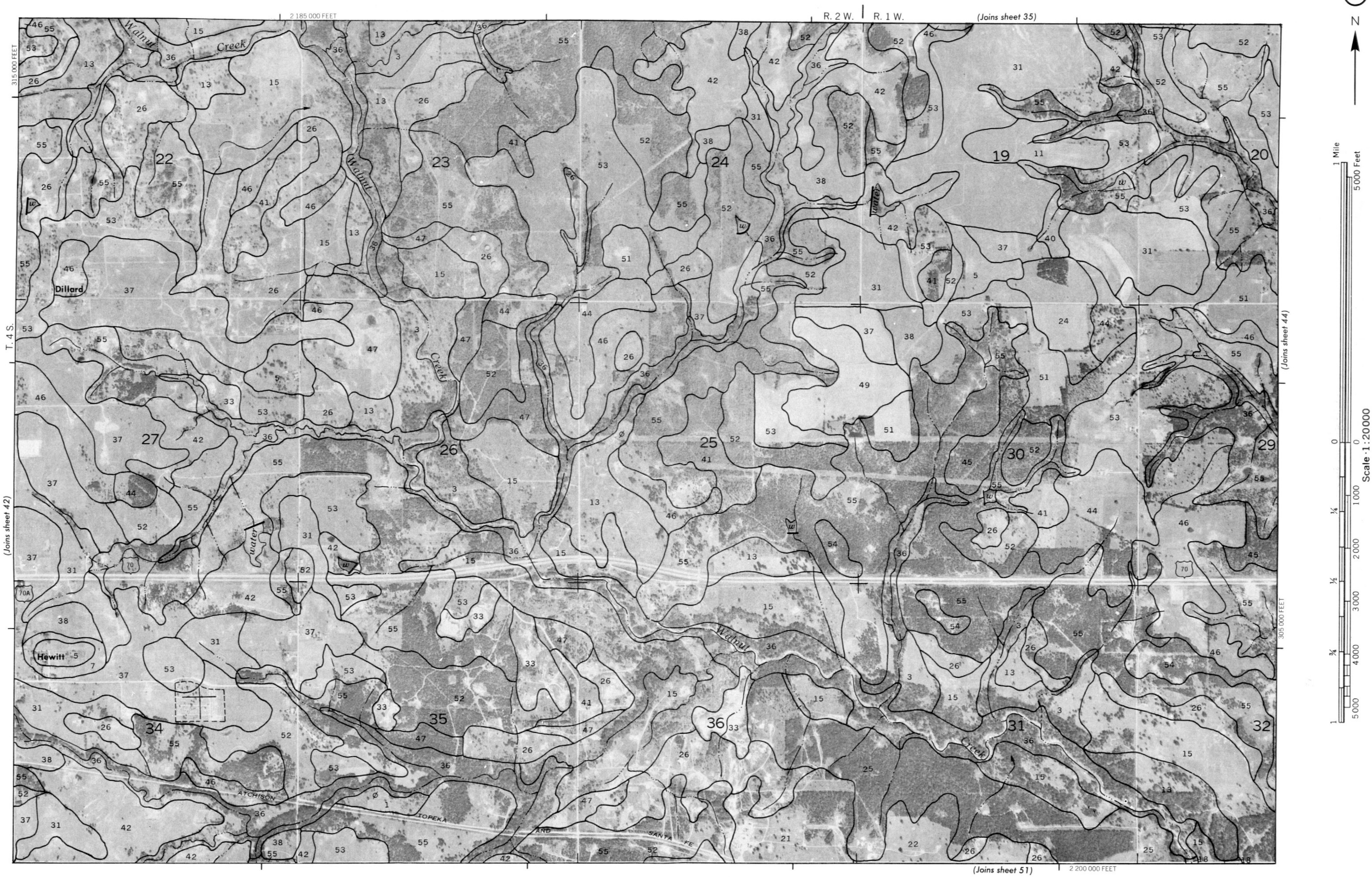
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



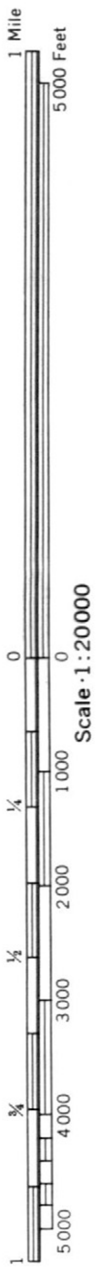
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

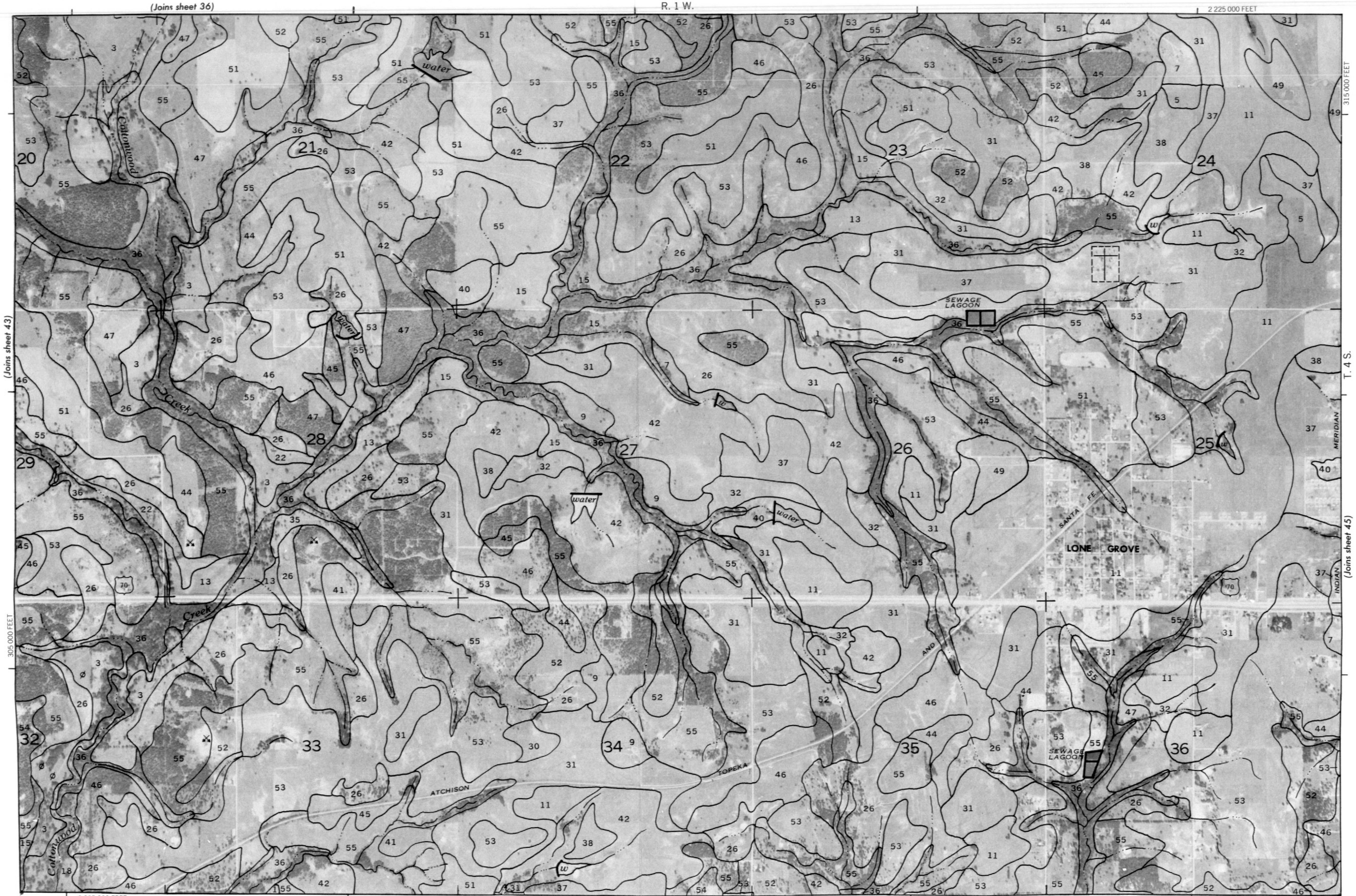


This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

44

N

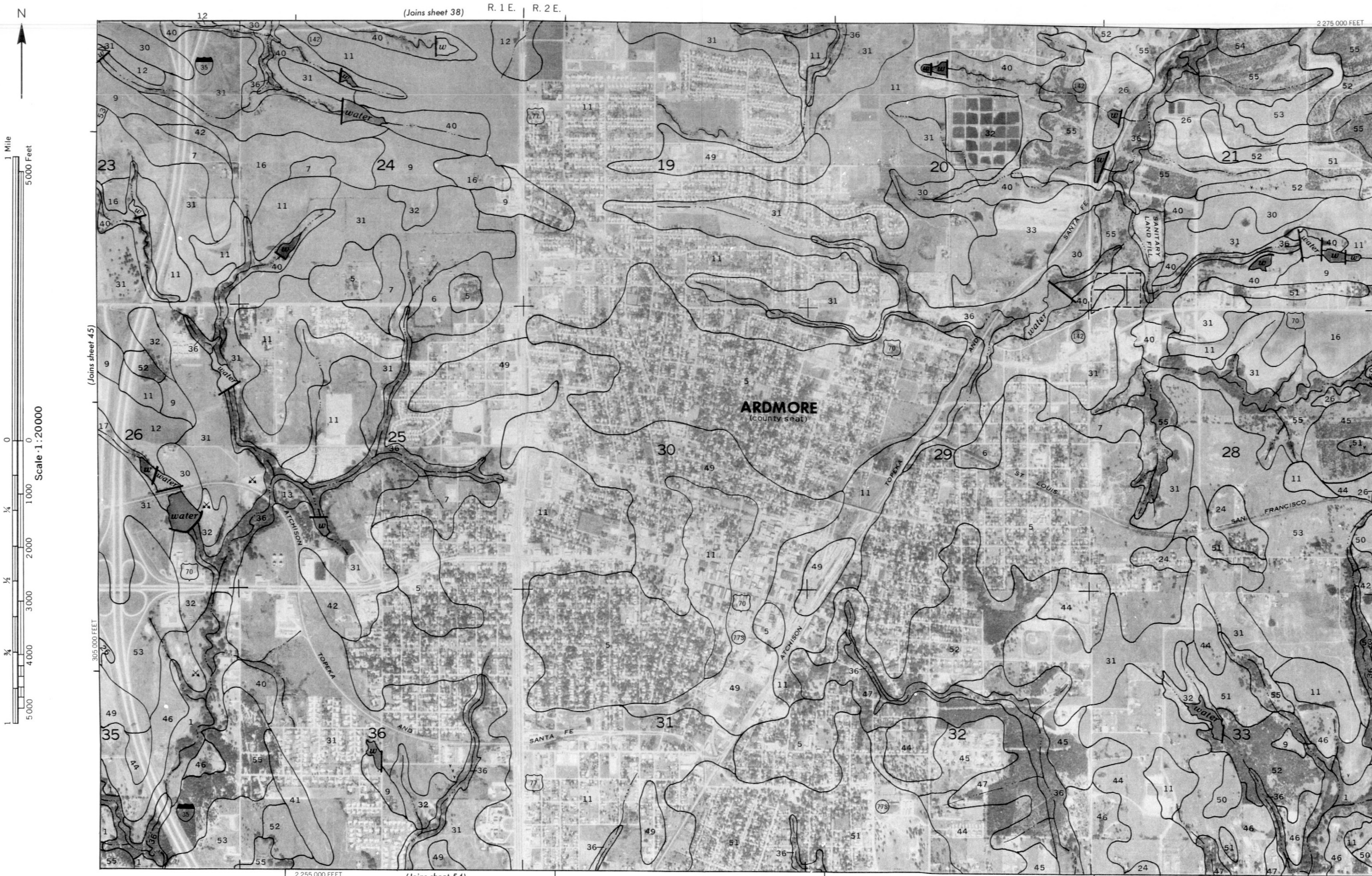




This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARTER COUNTY, OKLAHOMA NO. 45

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



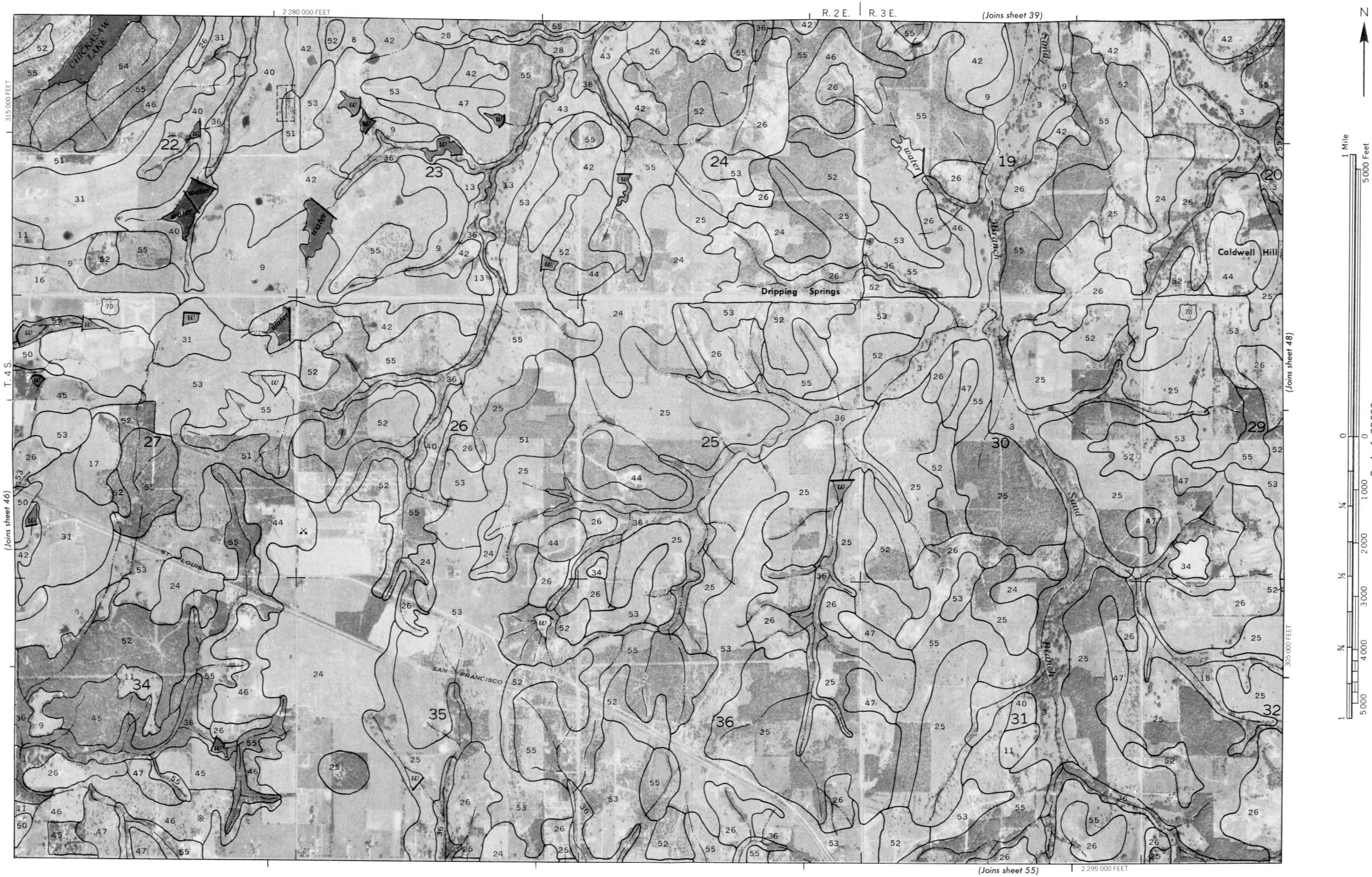
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

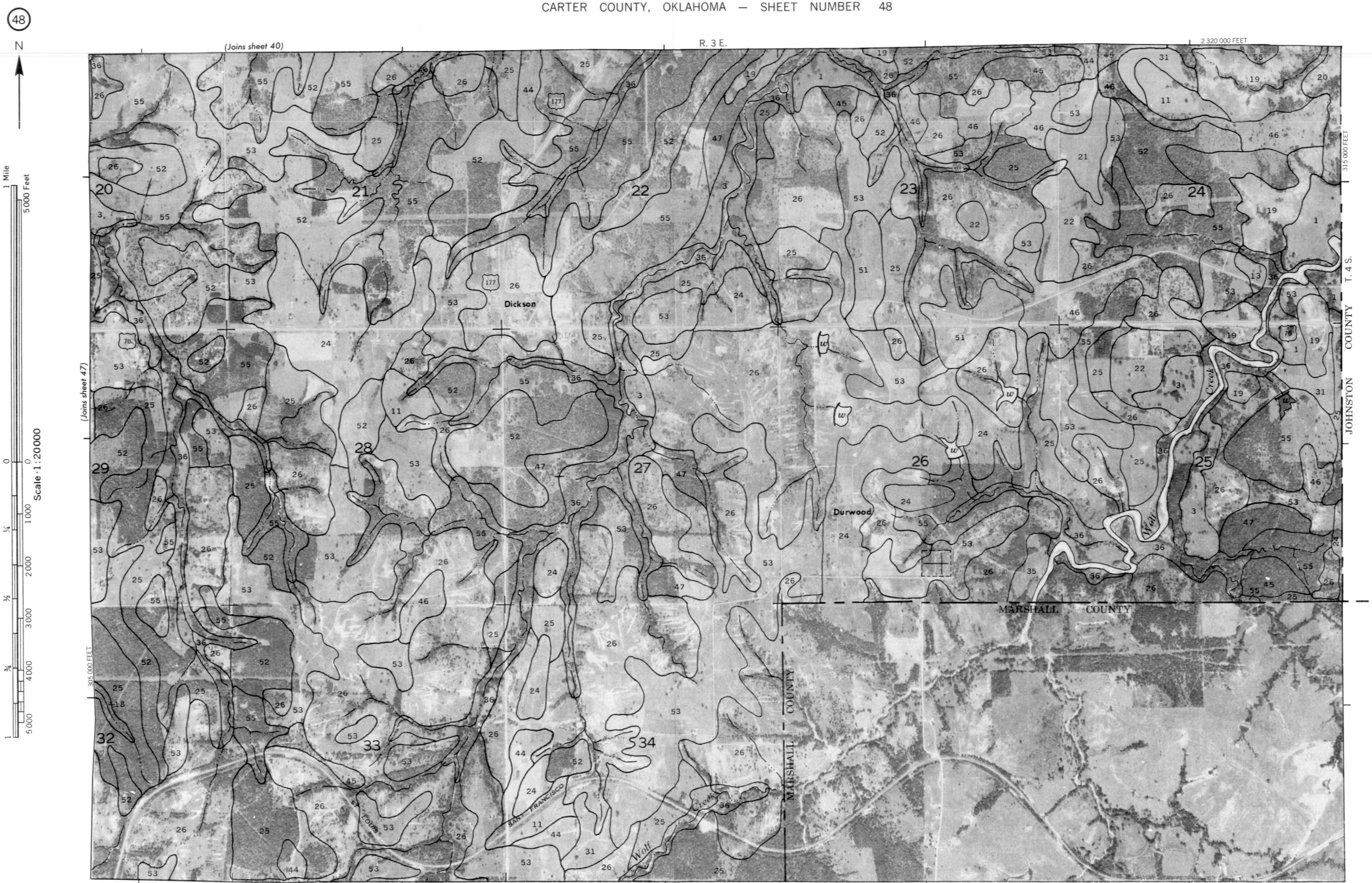
CARTER COUNTY, OKLAHOMA NO. 46

47

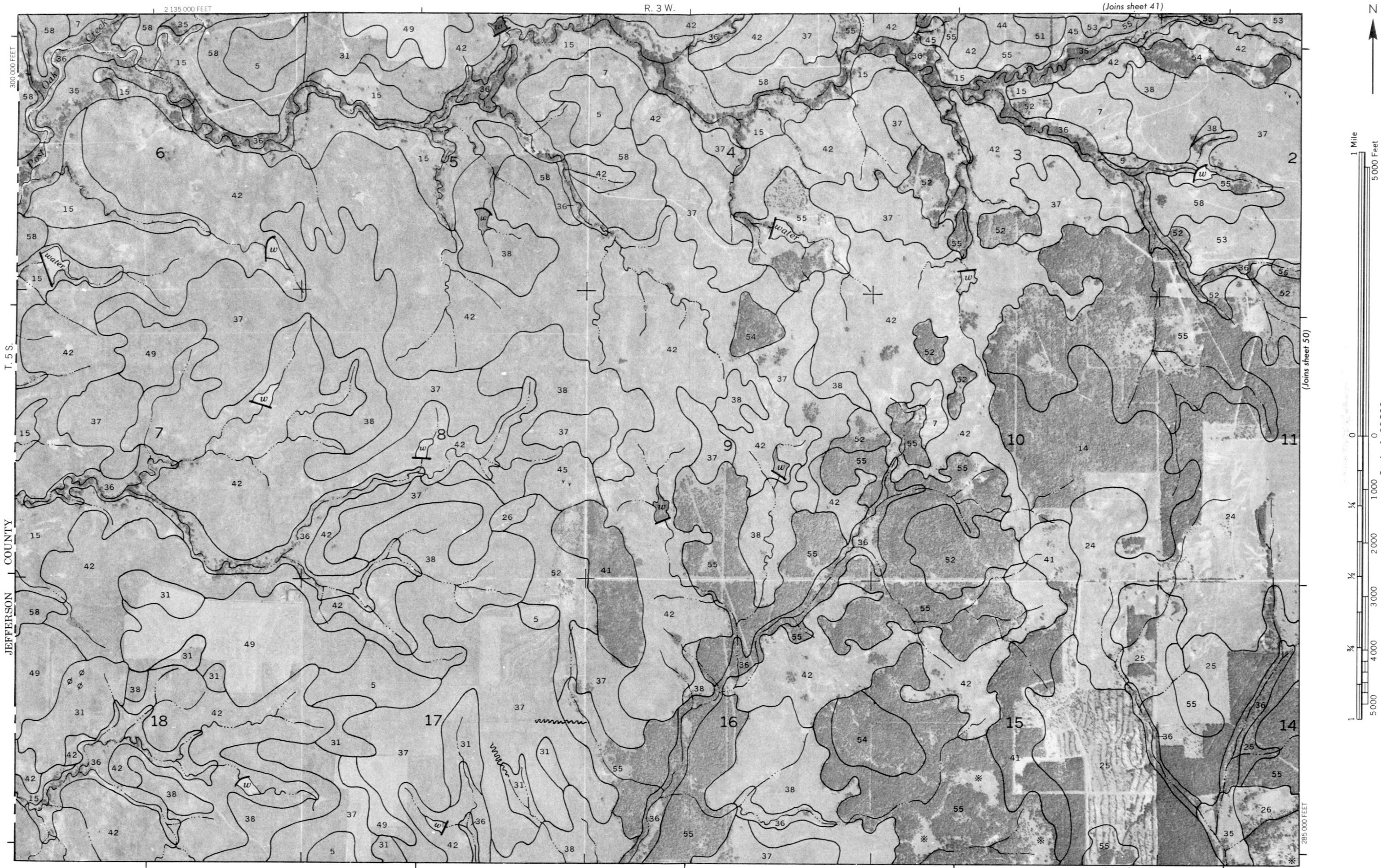
CARTER COUNTY, OKLAHOMA NO. 47

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



CARTER COUNTY, OKLAHOMA NO. 49

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARTER COUNTY, OKLAHOMA NO. 5

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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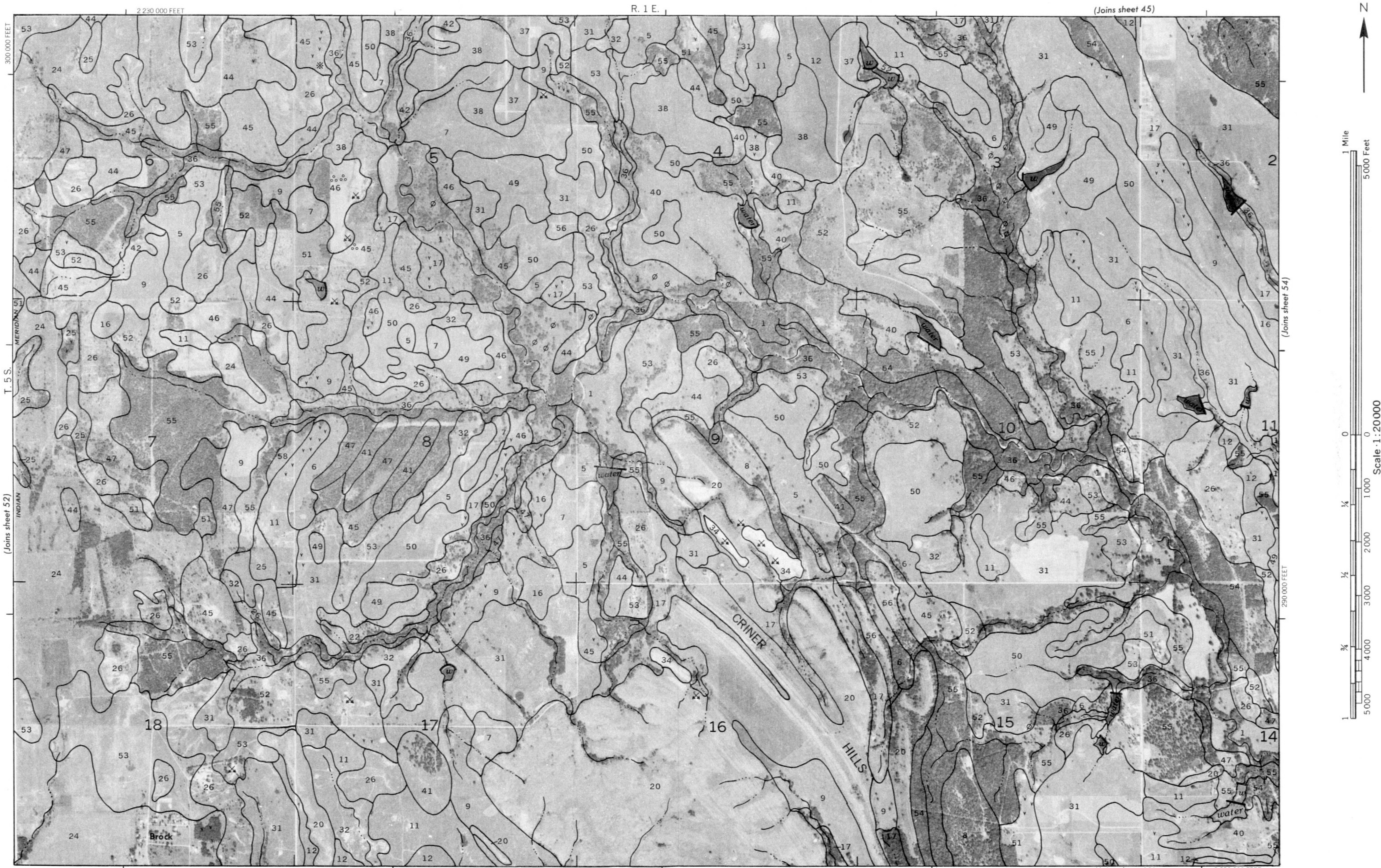
CARTER COUNTY, OKLAHOMA NO. 50

CARTER COUNTY, OKLAHOMA NO. 51

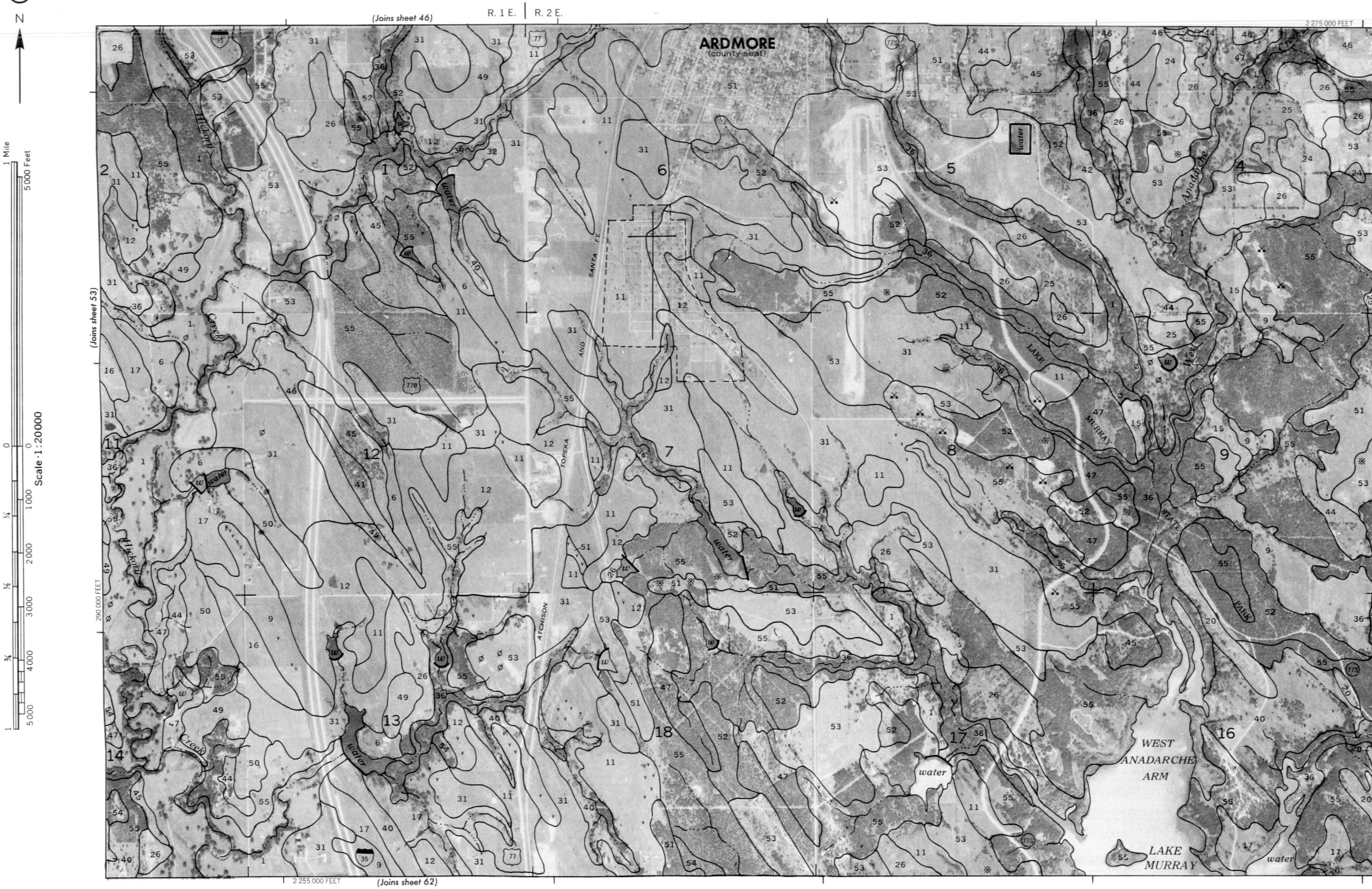
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



CARTER COUNTY, OKLAHOMA NO. 53

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARTER COUNTY, OKLAHOMA NO. 54

CARTER COUNTY, OKLAHOMA NO. 55

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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CARTER COUNTY, OKLAHOMA NO. 56

CARTER COUNTY, OKLAHOMA NO. 57

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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CARTER COUNTY, OKLAHOMA NO. 58

CARTER COUNTY, OKLAHOMA NO. 59

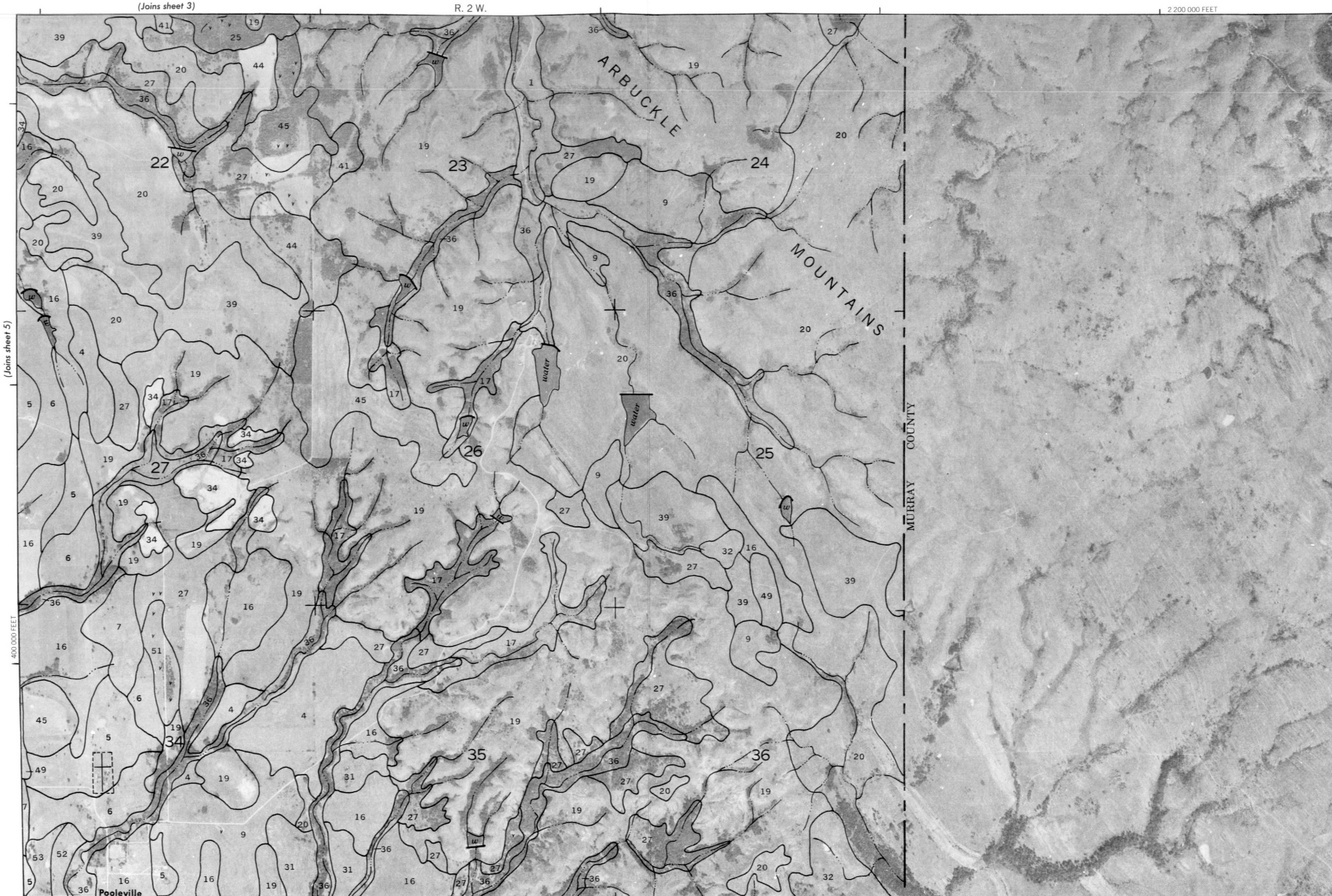
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

Scale 1:20000

1 Mile

5000 Feet



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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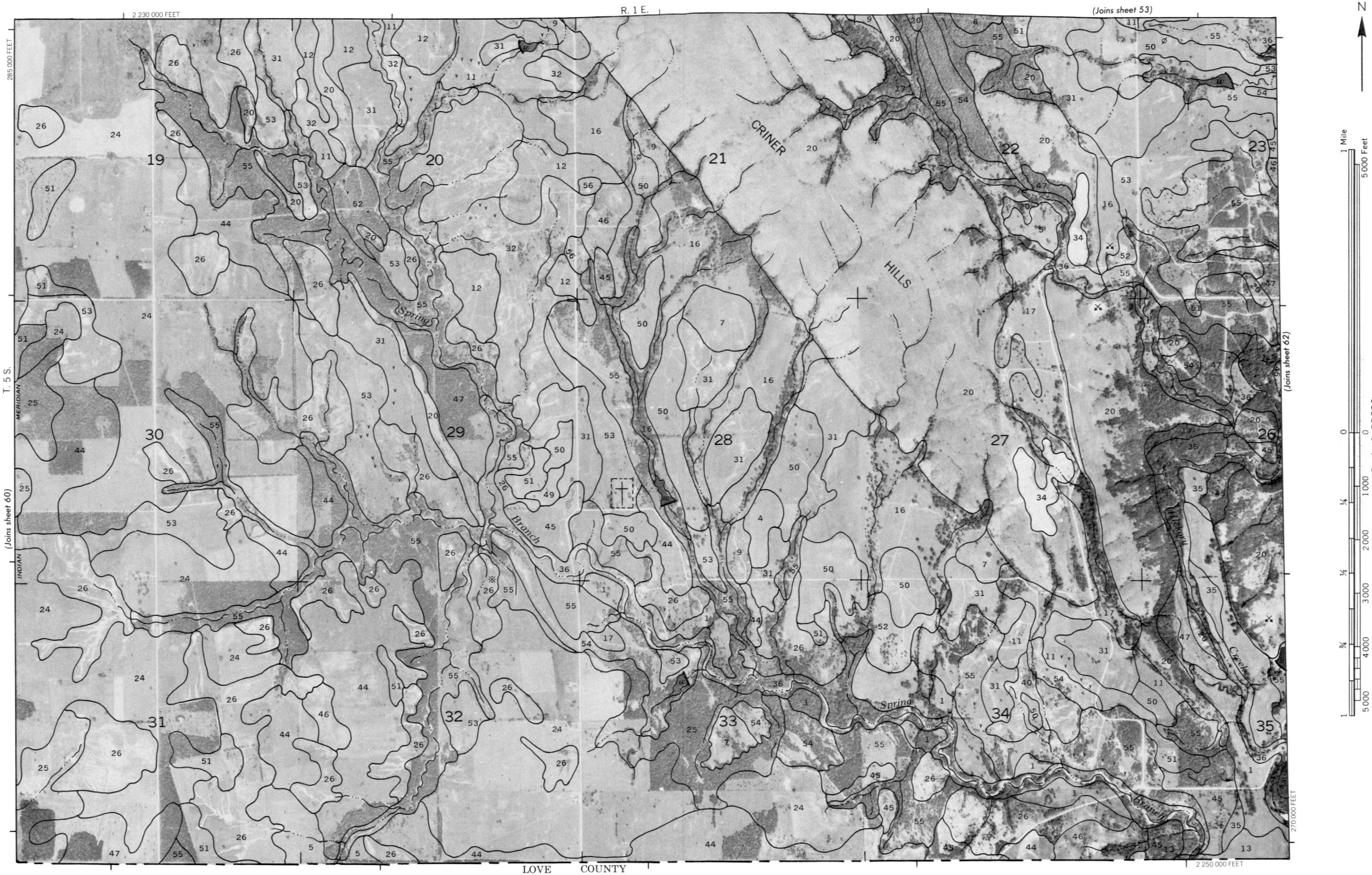
CARTER COUNTY, OKLAHOMA NO. 60



CARTER COUNTY, OKLAHOMA NO. 61

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

63

N

CARTER COUNTY, OKLAHOMA NO. 63

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 Mile
5000 Feet
Scale 1:20000

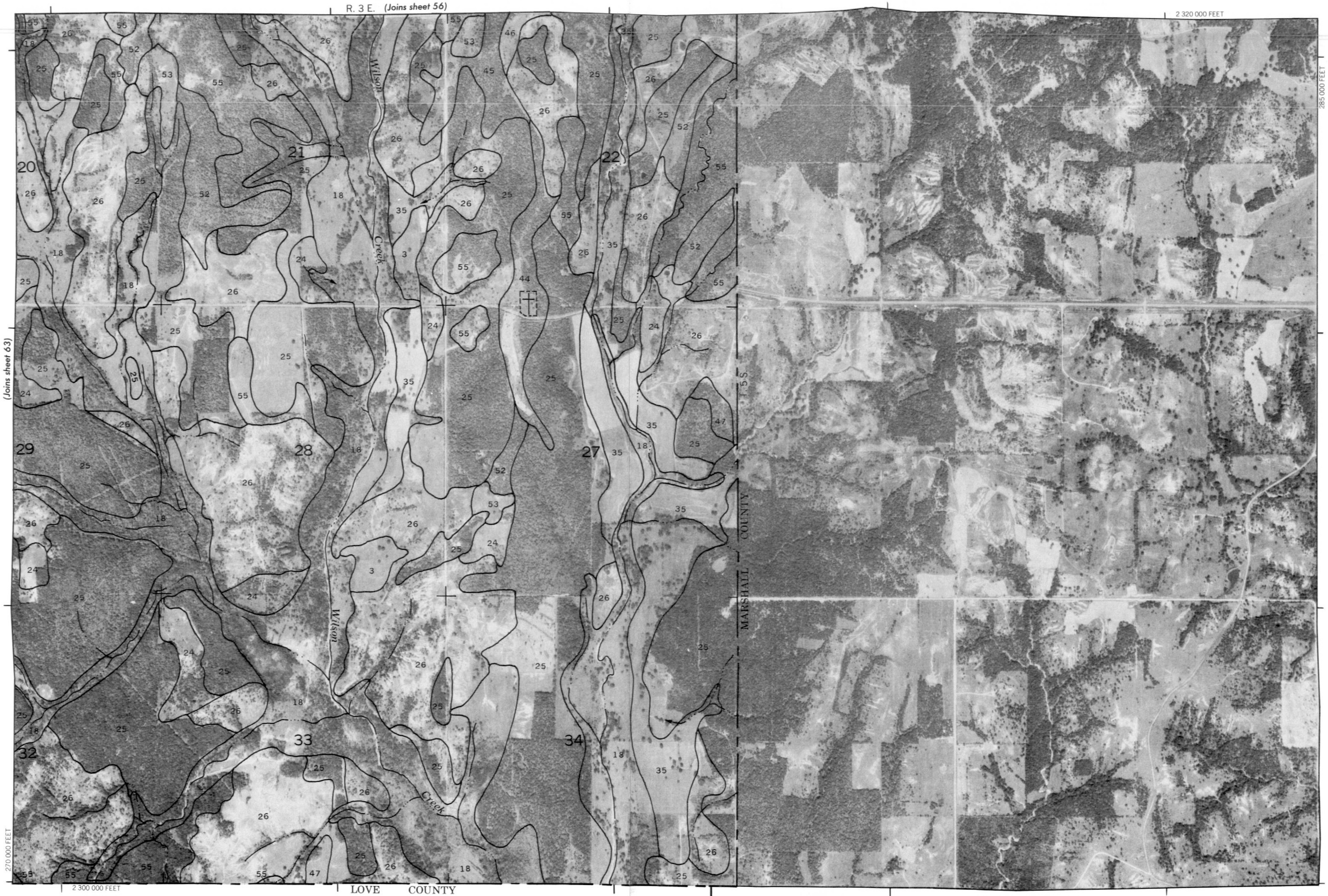
N

1 Mile | 5 000 Feet

Scale 1:20000

0 | ¼ | ½ | ¾ | 1

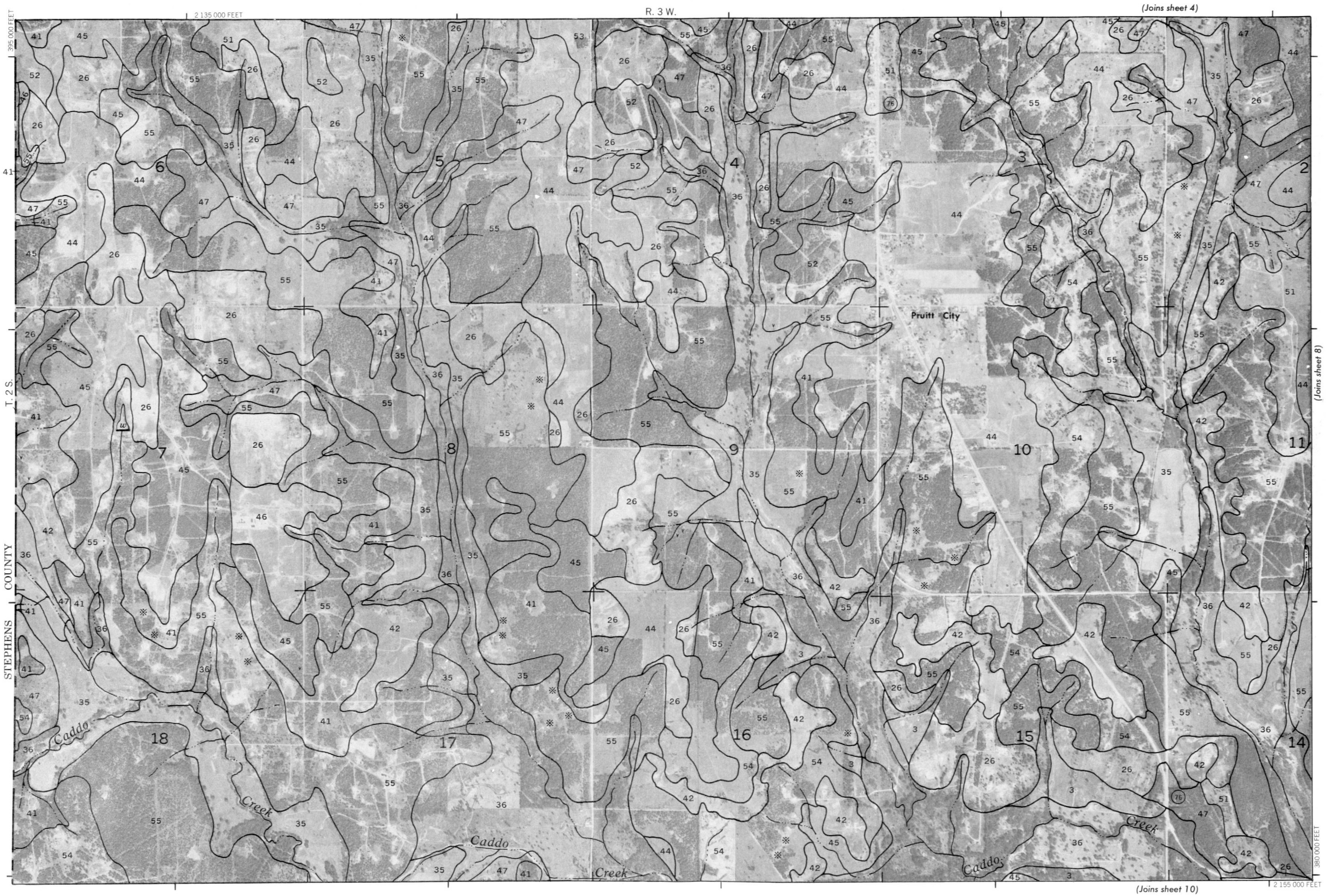
0 | 1000 | 2000 | 3000 | 4000 | 5000



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARTER COUNTY, OKLAHOMA NO. 64

7



N

Scale 1:20000
1 Mile
5000 Feet

CARTER COUNTY, OKLAHOMA NO. 7

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARTER COUNTY, OKLAHOMA NO. 8

CARTER COUNTY, OKLAHOMA NO. 9

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.